SEPTEMBER

1948

CIVIL ENGINEERING

CAISSON, sunk to solid rock ... island, forms air shaft and ... for ventilation building at ... Battery Tunnel. See story, page ...

Modern Design and Rigid Controls Produce Sound Concrete in Ross Dam—Faulkner

Pile Tests for Design and Construction Economy—Thornley

Proposed Allegheny-Genesee Waterway Links Vital Inland Water Systems—Long

Precast Concrete Wall Panels Prove Economical Substitute for Brick—Topping

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American Society of Civil Engineers

1948 Fall Meeting

ston, Massachusetts — HOTEL STATLER — *October 13–15, 1948*

Celebrating the 100th Anniversary of the Boston Society of Civil Engineers

Registration: Mezzanine, Statler Hotel, 9:00 a.m., Wednesday, October 13

October 13

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Commissioner of Public Works, Boston, Mass.

:20 **The Effect of the Master Plan for Highways on the Urban Business District**

T. T. McCrosky,* Executive Director, Greater Boston Development Committee, Inc., Boston, Mass.

:40 **Suburban Areas and Their Relation to the Master Plan for Highways**

Charles A. Blessing,* Chief City Planner, Chicago Plan Commission, Chicago, Ill.

Discussion

3:30 **An Integrated Parking and Expressway Plan for Downtown Boston**

Fred J. Hughes, Planning and Program Engineer, Federal Works Agency.

9:00 **Cost Control Problems on Reclamation Projects**

Kenneth W. Markwell,* Assistant Commissioner, Bureau of Reclamation, Washington, D.C.

Discussion

1:40 **Engineering in Construction Cost Control**

R. H. Heitman,* Chief Engineer, Western Contracting Co., Sioux City, Iowa

Discussion

3:20 **Cost Control in the Construction Industry**

H. P. Maxton,* Secy.-Asst. Treas., Raymond Concrete Pile Co., New York, N.Y.

Discussion

w England Engineering Education

Leonard Carmichael, President, Tufts College, Medford, Mass.

Scientist Looks at Engineering

George R. Harrison, Dean of Science, Massachusetts Institute of Technology, Cambridge, Mass.

sday Afternoon

Power Division

2:00 P.M. — **PARLOR A**

residing: Arthur T. Larned, Chairman, xecutive Committee, Power Division*

2:00 **Opening Remarks by**

Arthur T. Larned,* Chairman, Chief Civil Engineer, Ebasco Services, Inc., New York, N.Y.

2:05 **Berlin, N.H., Hydroelectric Development**

H. D. Resseguie, Construction Engineer, and W. C. Tallman, Technical Asst., Public Service Company of New Hampshire, Manchester, N.H.

Discussion

2:55 **Water Power Storage in Maine**

Howard M. Turner,* Consulting Engineer; Professor of the Practice of Civil Engineering, Harvard University, Boston, Mass.

Discussion

3:45 **New England Interconnections and System Operation**

Clement P. Corey, Chief System Dispatcher, New England System, Millbury, Mass.

Discussion

* Members of the American Society of Civil Engineers.

American Society of Civil Engineers

1948 Fall Meeting

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Registration: Mezzanine, Statler Hotel, 9:00 a.m., Wednesday, October 13

Introduction to Boston, Wednesday, October 13

10:00 A.M. BALLROOM, HOTEL STATLER

lcome by Northeastern Section

MILES N. CLAIR,* President, North-astern Section, ASCE; Vice-President, The Thompson & Lichtner Co., Inc., Boston, Mass.

ssachusetts and Civil Engineers

ROBERT F. BRADFORD, Governor, Com-monwealth of Massachusetts.

A Civil Engineering Convention in Boston

JAMES M. CURLEY, Mayor, City of Boston.

Response

RICHARD E. DOUGHERTY,* President, ASCE; Vice-President, New York Central System, New York, N.Y.

New England Engineering Education

LEONARD CARMICHAEL, President, Tufts College, Medford, Mass.

A Scientist Looks at Engineering

GEORGE R. HARRISON, Dean of Science, Massachusetts Institute of Technology, Cambridge, Mass.

Sessions of Technical Divisions, Wednesday Afternoon

ity Planning and Highway Divisions Joint Session

2:00 P.M. BALLROOM

esiding: Frank H. Malley, Chairman, ecutive Committee, City Planning Division*

:00 Metropolitan Boston Master Plan for Highways

ADMIRAL WILLIAM H. BURACKER, Commissioner of Public Works, Boston, Mass.

:20 The Effect of the Master Plan for Highways on the Urban Business District

T. T. MCCROSKY,* Executive Director, Greater Boston Development Com-mittee, Inc., Boston, Mass.

:40 Suburban Areas and Their Relation to the Master Plan for Highways

CHARLES A. BLESSING,* Chief City Planner, Chicago Plan Commission, Chicago, Ill.

Discussion

:30 An Integrated Parking and Express-way Plan for Downtown Boston

FRED J. HUGHES, Planning and Pro-gram Engineer, Federal Works Agency, Public Roads Administration, Albany, N.Y.

Discussion

Construction Division

2:00 P.M. SALLE MODERNE

Presiding: Kirby Smith, Chairman, Executive Committee, Construction Division*

9:00 Cost Control Problems on Rec-lamation Projects

KENNETH W. MARKWELL,* Assistant Commissioner, Bureau of Reclamation, Washington, D.C.

Discussion

1:40 Engineering in Construction Cost Control

R. H. HEITMAN,* Chief Engineer, Western Contracting Co., Sioux City, Iowa

Discussion

3:20 Cost Control in the Construction Industry

H. P. MAXTON,* Secy.-Asst. Treas., Raymond Concrete Pile Co., New York, N.Y.

Discussion

Power Division

2:00 P.M. PARLOR A

Presiding: Arthur T. Larned, Chairman, Executive Committee, Power Division*

2:00 Opening Remarks by

ARTHUR T. LARNED,* Chairman, Chief Civil Engineer, Ebasco Services, Inc., New York, N.Y.

2:05 Berlin, N.H., Hydroelectric De-velopment

H. D. RESSEGUIE, Construction Engi-neer, and W. C. TALLMAN, Technical Asst., Public Service Company of New Hampshire, Manchester, N.H.

Discussion

2:55 Water Power Storage in Maine

HOWARD M. TURNER,* Consulting Engineer; Professor of the Practice of Civil Engineering, Harvard University, Boston, Mass.

Discussion

3:45 New England Interconnections and System Operation

CLEMENT P. COREY, Chief System Dis-patcher, New England System, Millbury, Mass.

Discussion

* Members of the American Society of Civil ngineers.

Social Activities, Wednesday, October 13

12:00 Noon Membership Luncheon — Ballroom, Statler Hotel

JOHN B. BABCOCK, 3RD,* Professor, Railroad Engineering, Massachusetts Institute of Technology, will address the luncheon on the subject, "Common Origins of the Boston Society of Civil Engineers and the American Society of Civil Engineers." All members, their ladies, guests and friends of ASCE and BSCE are cordially invited to attend.

Excursion and Tea for Women, 2:30 p.m.

Special buses for the occasion will leave the Statler Hotel at 2:30 p.m. A tour of the Fogg Museum will include a tea sponsored by the Women's Committee on Arrangements.

Dinner-Dance, Statler Ballroom

8:00 p.m. Dinner

9:30 p.m. Dancing

Special tickets for the dancing only are available for members of ASCE Student Chapters.

Sessions of Technical Divisions, Thursday Morning

Air Transport Division

10:00 A.M. SALLE MODERNE

Presiding: Everett C. Crites, Member, Executive Committee, Air Transport Division

10:00 Model Studies on Airfield Drainage Structures

MARTIN E. NELSON,* Corps of Engineers, St. Paul, Minn., and HARVEY J. JOHNSON,* Corps of Engineers, St. Paul, Minn.

Discussion

10:30 Gutter-Type Drainage Systems in Snow Areas

W. E. CULLINAN, JR., Superintendent, Airports Branch, Region I, Civil Aeronautics Administration, New York, N.Y.

Discussion

11:00 Recess

11:15 Airfield Drainage Deficiencies

HAROLD A. SCOTT,* Corps of Engineers, Jacksonville, Fla., and FREDERICK J. RAWSTROM,* Corps of Engineers, Savannah, Ga.

Discussion

Sanitary Engineering Division

Joint Session with the Boston Society of Civil Engineers

10:00 A.M. BALLROOM

Presiding: Gordon M. Fair, Member, Executive Committee, Sanitary Engineering Division*

10:00 Pollution Abatement Policy

THOMAS R. CAMP* of Camp, Dresser and McKee, Consulting Engineers, Boston, Mass.

Discussion

10:30 Pollution of the Androscoggin River by Industrial Wastes and Control Measures Thereof

E. SHERMAN CHASE* of Metcalf & Eddy, Consulting Engineers, Boston, Mass.

Discussion

11:00 Utilidors for Water, Sewer, and Other Underground Utilities in Arctic Climates

WILLIAM L. HYLAND* and MURRAY H. MELLISH* of Fay, Spofford & Thorndike, Consulting Engineers, Boston, Mass.

Discussion

11:30 The New Water Supply Tunnel of the Boston Metropolitan District Commission

KARL R. KENNISON,* Chief Engineer, Construction Division, Metropolitan District Commission

Discussion

Soil Mechanics and Foundations Division

9:45 A.M. GEORGIAN ROOM

Presiding: Frank A. Marston, Chairman, Executive Committee, Soil Mechanics and Foundations Division*

9:45 Field Measurements of Earth Pressures and Deflections

DONALD W. TAYLOR,* Assoc. Prof. of Soil Mechanics, Mass. Inst. of Technology, Cambridge, Mass.

10:15 Settlement of Hydraulic Clay Fill on Clay Foundation

ARTHUR CASAGRANDE,* Prof., Soil Mechanics and Foundations, Harvard Univ.

11:00 Strength of Natural Clays

PHILIP C. RUTLEDGE,* Prof., Civil Engineering, Technological Inst., Northwestern Univ., Evanston, Ill.

Discussion

Photo courtesy New England Council

TOURS DURING FALL MEETING include points of historic and engineering interest in and about Boston. Pictured here is Boston Light, familiar landmark on Atlantic Coast.

Sessions of Technical Divisions, Thursday Afternoon

Soil Mechanics and Foundations Division

2:00 P.M. GEORGIAN ROOM

Presiding: Frank A. Marston, Chairman, Executive Committee, Soil Mechanics and Foundations Division*

2:00 **Reports from Second International Conference on Soil Mechanics and Foundation Engineering, held at Rotterdam, June 1948**

2:05 KARL TERZAGHI,* Section III, Field Investigations

2:35 THOMAS A. MIDDLEBROOKS,* Section IV, Stability and Deformations of Earth Constructions

3:05 WILLARD J. TURNBULL,* Section II, Laboratory Investigations

3:50 FRANK A. MARSTON,* Section IX, Improvement of Mechanical Properties of the Soil

Discussion

NOTE: A Friday excursion is sponsored by the Soil Mechanics and Foundations Division.

Structural Division

2:00 P.M. BALLROOM

Presiding: Prof. J. M. Garrelts, Secretary, Executive Committee, Structural Division*

2:00 **Buckling of Rigid-Jointed Plane Trusses**

N. J. HOFF, Prof., Aeronautical Engineering, Brooklyn Polytechnic Inst., Brooklyn, N.Y.

Discussion

2:45 **Controlled Impulsive Loadings of Simple Reinforced Concrete Beams**

ROBERT J. HANSEN,* Assistant Prof. of Structural Engineering, Massachusetts Inst. of Technology, Cambridge, Mass.

Discussion

3:15 **Engineering in the Far North**

CHARLES M. SPOFFORD,* Prof. Emeritus; Consulting Engineer, Boston, Mass.

Discussion

Social Activities, Thursday, October 14

All-Day Excursion for Women—Trip to Concord and Lexington

10:00 a.m. Special buses leave Statler Hotel for visit to historic scenes. Luncheon at Colonial Inn, Concord, Mass.

Smoker—Georgian Room, Statler Hotel

8:00 p.m. Evening program provides an opportunity for sociability with buffet refreshments. JAMES J. BRITT, sports announcer, will bring some unusual highlights of his "Experiences as a Sports Announcer." Members are invited to bring their ladies and guests to this function.

Surveying and Mapping Division

2:00 P.M. PARLOR A

Presiding: J. S. Dodds, Chairman, Executive Committee, Surveying and Mapping Division*

2:00 **The History of Land Titles and Title Records in Massachusetts**

DORR VIELE, Counselor-at-law, Boston, Mass.

Discussion

2:45 **The Engineer and the Massachusetts Land Court**

WILLIAM T. FAIRCLOUGH, Engineer of the Massachusetts Land Court.

Discussion

PROF. A. H. HOLT,* Worcester Polytechnic Inst.

3:15 **Control Surveying in Massachusetts**

E. C. HOUDLETTE, Massachusetts Geodetic Survey, Dept. of Public Works.

Discussion

PROF. H. J. SHEA, Massachusetts Institute of Technology.

Excursions, Friday, October 15

Soil Mechanics and Foundations Excursion

9:00 a.m. Special buses leave Statler Hotel, Columbus Avenue entrance, for trip sponsored by the Soil Mechanics and Foundations Division to the Soil Mechanics Laboratories at Massachusetts Institute of Technology and Harvard University. Price, 40 cents.

Waterways Excursion

9:00 a.m. Boat trip inspecting Boston Harbor installations is sponsored by the Waterways Division. Price, $2.00.

North Shore Trip

10:30 a.m. Special buses leave the Statler Hotel for a tour of points of interest along the North Shore area, with luncheon at the Gloucester Tavern.

Air Transport and Soil Mechanics Excursion

1:00 p.m. Special buses leave the Statler Hotel for Watertown Arsenal Soils Laboratory. Price, $1.15.

Other Trips

Throughout the morning other trips to points of interest such as Harvard University, Massachusetts Institute of Technology, Northeastern University, Tufts College, Boston Airport, Navy Dry Dock, Maverick Square Airport Tunnel, Mystic River Bridge foundations, Nut Island Sewage Treatment Plant, Chestnut Hill Reservoir Tunnel, historic canals and locks in Lowell and the Lawrence Experiment Station, will be arranged as requests are made.

Friday, New England Shore Dinner

The Tavern, Gloucester, Mass.

12:00 p.m. Special buses leave the Statler Hotel for Gloucester. A good old New England Shore Dinner with all the trimmings will be served at 1:30.

BOSTON WATERFRONT reflects city's enterprise. Friday boat trip permits inspection of harbor installations.

Student Chapter Conference Tuesday, October 12

SALLE MODERNE, HOTEL STATLER

A conference of delegates and members of all ASCE Student Chapters in the New England area will be held in connection with the Fall Meeting. This is sponsored by the New England Section, ASCE. The morning session will be devoted to topics of interest to Chapter members, while for the afternoon an excursion to points of engineering interest has been arranged.

Opportunity for students to meet with members of the ASCE Board of Direction will be provided at a Tuesday luncheon sponsored by the members of the New England Section. Student price, $1.00.

All events of the Fall Meeting are open to members of Student Chapters and a cordial invitation is extended to them to attend.

Hotel Accommodations and Meeting Headquarters Information Desk

Information Desk

An information desk will be maintained at Fall Meeting Headquarters in the Hotel Statler for the convenience of visiting members and guests. Mail will be delivered to members at addresses given in registration or held at the registration desk. All undelivered mail will be forwarded to home addresses at close of the meeting. A special message service will be in operation at the registration desk.

Make Hotel Reservations Early

(See page 86)

The Statler Hotel in Boston is the headquarters for the Fall Meeting. Most events—unless otherwise noted—will be held in this hotel. All attending the meeting are urged to make requests for reservation of hotel accommodations as early as possible. A special form for such reservation has been provided (page 86).

Hotel Rates

Hotels	Single Room	Double Room	Twin Room	Suite
Statler	$4.25–6.25	$7.25– 9.75	$9.00–12.00	$15.00–25.00
Copley-Plaza	4.50–6.60	7.25– 8.80	8.80–11.00	15.00–25.00
Parker House	4.00–6.50	6.25– 8.50	8.00–10.00	14.00–16.00
Ritz-Carlton	6.00–9.50	. . . . .	11.00–13.00	24.00–32.00
Kenmore	4.00–6.50	6.50– 9.50	7.00–10.50	10.00–16.00
Puritan	5.00–8.00	. . . . . .	7.50–12.00	12.00–18.00
Sheraton	4.00–5.50	7.00–10.00	7.00–10.00	8.00–20.00
Bellevue	4.00–6.00	6.00– 8.00	7.25–10.00	12.00–15.00
Somerset	5.00–7.00	. . . . . .	9.00–11.00	12.00–25.00
Touraine	4.00–6.00	6.00– 9.00	7.50– 9.00	14.00–16.00

HEADQUARTERS FOR ASCE FALL MEETING in Boston is Hotel Statler, where all sessions of Technical Divisions and many social activities are held.

Committees for 1948 Fall Meeting

Executive Committee

Harrison P. Eddy, Jr., *General Chairman*
Albert Haertlein, *Director ASCE*
Fred H. Paulson, *representing Providence Section*
Harold L. Blakeslee, *representing Connecticut Section*
Miles N. Clair, *President, Northeastern Section; Chairman, Finance Committee*
Frank A. Marston, *Chairman, Subcommittee on Technical Program*
Howard M. Turner, *Chairman, Hotel and Registration Committee*
Emil A. Gramstorff, *Past-President, Northeastern Section; Chairman, Committee on Student Participation*
Ralph W. Horne, *Chairman, Entertainment and Transportation Committee*
Mrs. Charles B. Breed, *Chairman, Ladies' Committee on Arrangements*

Finance Committee

Miles N. Clair, *Chairman*
Frank M. Gunby — Edward H. Cameron
Carroll A. Farwell — James F. Fitzgerald
Francis V. Bulfinch

Technical Program Committee

Frank S. Marston, *Chairman*
Athole B. Edwards — Byron O. McCoy
Charles Y. Hitchcock, Jr. — Lincoln W. Ryder

Hotel and Registration Committee

Howard M. Turner, *Chairman*
Francis H. Kingsbury — Harry M. Nelson
Maurice A. Reidy

Student Participation Committee

Emil Gramstorff, *Chairman*
(The faculty advisers to students in the six New England States)

Entertainment and Transportation Committee

Ralph W. Horne, *Chairman*
E. B. Myott — William E. Stanley
Frederick S. Gibbs — Harry P. Burden
F. M. Cahaly

Ladies' Committee on Arrangements

Mrs. C. B. Breed, *Chairman*
Mrs. H. P. Eddy, Sr., *Honorary*
Mrs. F. E. Winsor, *Honorary*
Mrs. C. M. Spofford — Mrs. R. W. Horne
Mrs. A. Haertlein — Mrs. K. R. Kennison
Mrs. M. N. Clair — Mrs. E. L. Moreland
Mrs. H. P. Eddy, Jr. — Mrs. A. L. Shaw
Mrs. C. S. Ell — Mrs. H. M. Turner
Mrs. E. A. Gramstorff — Mrs. J. B. Wilbur

Ladies' Reception and Information Committee

Mrs. Albert Haertlein, *Chairman*
Mrs. H. P. Burden — Mrs. E. F. Littleton
Mrs. T. R. Camp — Mrs. J. E. McKee
Mrs. G. M. Fair — Mrs. H. G. Protze, Jr.
Mrs. C. A. Farwell — Mrs. M. A. Reidy
Mrs. E. A. Gramstorff — Mrs. A. L. Shaw
Mrs. F. M. Gunby — Mrs. W. F. Uhl
Mrs. O. G. Julian — Mrs. F. N. Weaver
Mrs. H. M. Westergaard

Air Conditioning and Blank Walls Introduce New Fire Problems

R. C. CORSON

Engineer, Associated Factory Mutual Fire Insurance Companies, Boston, Mass.

MANY NEW AIR-CONDITIONED BUILDINGS and factories are being erected with blank exterior walls and an increasing number of older buildings are being air-conditioned, the window openings being sealed with glass block or brick masonry. Improvement in the efficiency of the conditioning systems and elimination of troublesome window condensation and maintenance are the reasons for this "new look" in building construction. The combination of air conditioning and blank walls introduces problems in fire protection and fire fighting which require careful attention, particularly in multi-storied combustible buildings. These problems must be considered in modern building construction.

EXTINGUISHING OF FIRES QUICKLY is of more than usual importance in a building having blank exterior walls. Fighting a fire which develops to serious proportions may prove very difficult. There are no windows through which to carry hose lines or play hose streams. About the time firemen must get in through doorways, the employees are getting out. Water damage will be greater because of the difficulty of fighting fire where smoke and gases are not liberated to outdoors. Confinement of heat may result in more sprinklers opening. A shielded fire or any occurrence which might overtax the water supply to sprinklers is likely to have serious consequences, even to the destruction of the building.

The problem of venting smoke from a blank-walled air-conditioned building has not so far been successfully met by most designers and installers of air-conditioning equipment, many such installations having been made with no provision for smoke removal.

In buildings of conventional construction, it has been customary to shut down air-conditioning fans at the start of a fire and vent heat and smoke by opening windows, skylights, and doors. In blank-walled buildings, however, some other means must be used to remove smoke and combustion gases so that a fire can be fought effectively, smoke damage kept at a minimum, and operations resumed promptly. Provision of sufficient smoke-venting windows or panels to accomplish this is not ordinarily practical because it defeats the purpose of a windowless building.

Special exhaust systems for the removal of smoke would not be justified in most instances. Smoke can be removed with reasonable effectiveness, however, by designing the air-conditioning system to vent smoke outdoors. Usually outdoor venting can be accomplished by arranging air-supply louvers so that a maximum amount of fresh air will be drawn into the ventilating system and discharged into the fire area, thus forcing smoke out through hinged louvers, which are usually installed in the outside walls of air-conditioned buildings and which open at a slight increase of air pressure within the building. A bulletin outlining the recommended arrangement of fire detectors and dampers is now in preparation by the Factory Mutual Inspection Department.

Venting through louvers may increase the rate of burning somewhat by introducing currents of fresh air, but the effect would not be much different from that obtained by opening windows and doors to remove smoke. Venting is necessary if fire is to be fought effectively.

Ventilating or air-conditioning equipment may be of the unit type serving one area only, or the central-station type, usually located in the basement or on the roof of a building and serving several or all stories through supply and return ducts. It is highly desirable from the standpoint of fire safety that air-condition-

(*Continued on page 80*)

AIR-CONDITIONED BLANK-WALL BUILDINGS have both advantages and disadvantages from fire standpoint. Air-conditioning standardizes humidity and temperature, produces higher standard of cleanliness, reduces lint accumulation in textile mills, and improves machine performance—all of which help to prevent fires. Blank brick walls (below, left) eliminate probability of damage from outside exposure fires, and glass block panels (below, right) provide some exposure protection. Many one-story blank-wall buildings with relatively non-combustible contents may be as safe from fire without windows as with them. In multi-storied combustible buildings such as cotton mills, however, considered solely from fire-safety standpoint, disadvantages far outweigh advantages, and every reasonable precaution is justified.

Progress of Work on Brooklyn-Battery Tunnel Indicates Early Completion Date

Caisson Sunk Through Man-Made Island Supports Ventilation Structure for Twin Vehicular Tubes

BROOKLYN-BATTERY TUNNEL is part of New York City's comprehensive arterial highway program. Traffic link will join West Side Highway, and later East Side Drive, at Manhattan end with Belt Parkway System in Brooklyn.

NOW 70 PERCENT complete after a seven-year struggle against material shortages, labor disputes, financing troubles and a three-year wartime shutdown, Brooklyn-Battery Tunnel in New York City is expected to be opened to traffic early in 1950 according to a recent estimate by Robert Moses, chairman of the Triborough Bridge and Tunnel Authority. Recently refinanced by the Reconstruction Finance Corporation, the tunnel cost has now risen, exclusive of real estate, to $77,000,000.

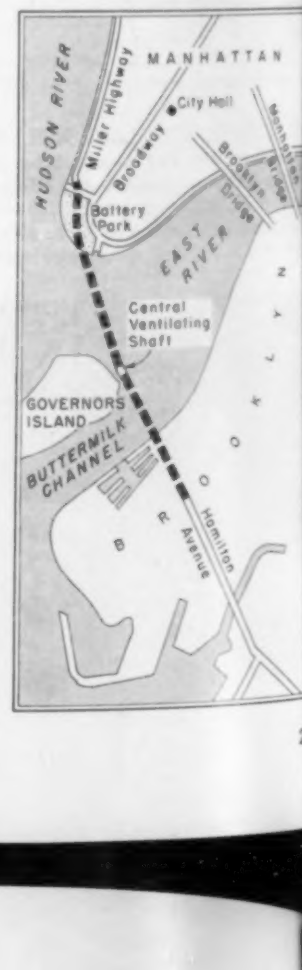
In its present stage the tunnel work consists of calking the 31-ft-dia segmented cast-iron rings of the twin tubes, pouring the concrete lining, constructing roadways and installing utilities. About one-third of the concrete lining has now been poured in both the Manhattan and Brooklyn halves of the tubes. The roadway, 21 ft wide from curb to curb, will carry two lanes of commercial and passenger traffic—to Brooklyn in the west tube and to Manhattan in the east tube. Traffic will move through the 9,117-ft length of the completed tubes in $3^1/_2$ minutes. The yearly capacity of the project is estimated at 16,000,000 vehicles.

Ventilated at Portals and Midpoint

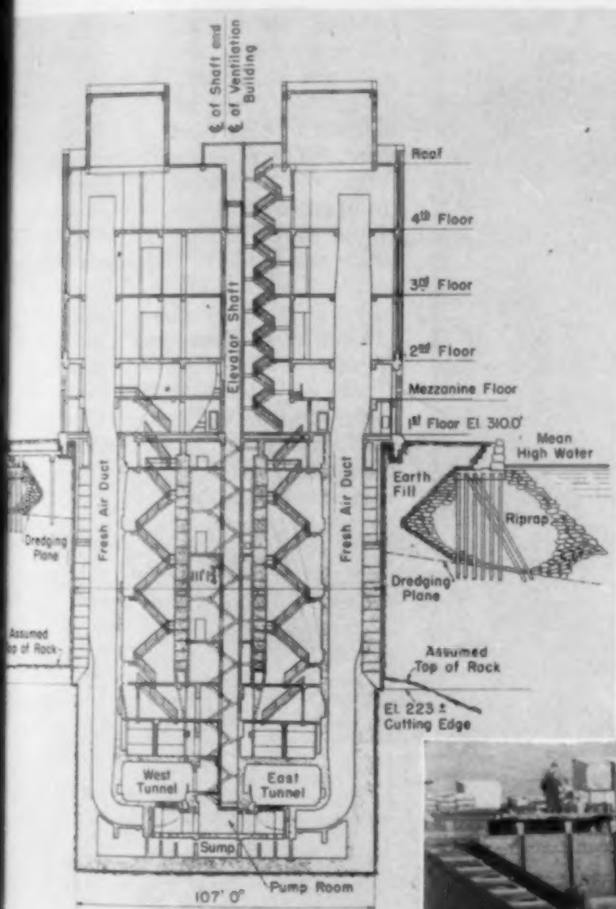
Because of the tunnel's length, ventilating equipment is needed at the

OCTAGONAL BUILDING over ventilating shaft at midpoint of two tunnels will house ventilating equipment, which with supplemental facilities at Manhattan and Brooklyn portals will provide fresh air for nearly 2 miles of twin vehicular tunnels.

LOCATION MAP SHOWS tunnel route and connections with highways in Manhattan and Brooklyn.

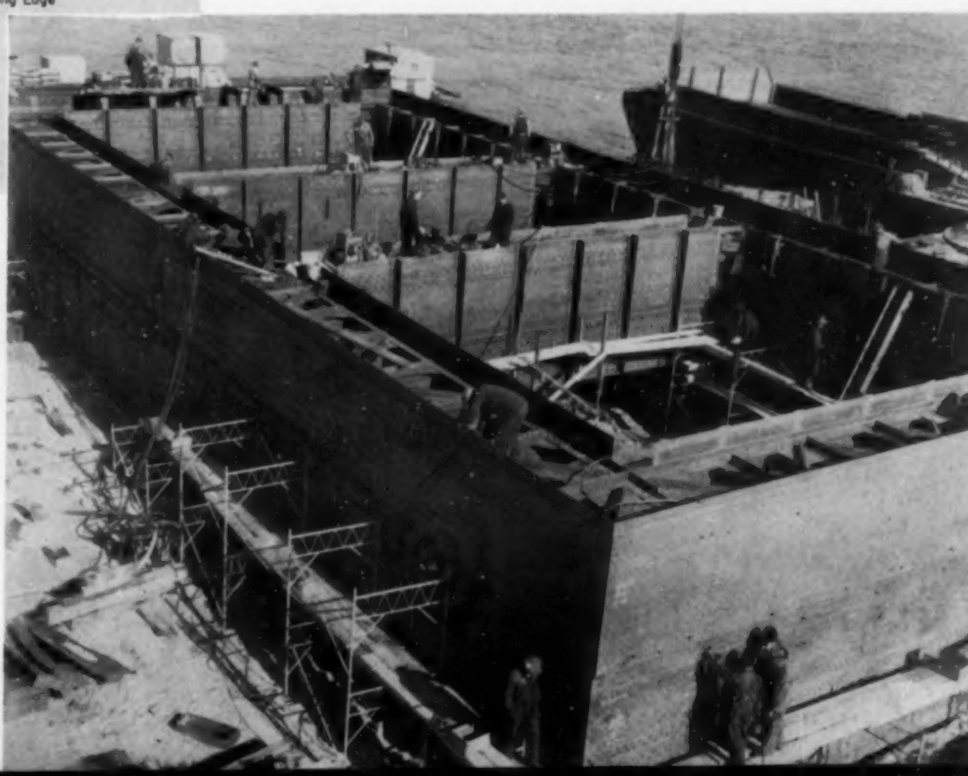


HARBOR IS DREDGED to hardpan (above, left) as first step in building island in East River to house tunnel ventilating equipment. Dredging operation is followed by backfilling with 10-ft clay blanket. Island's limits are defined by permanent fender system of vertical and battered piling forming octagonal area 200 ft across. View (above, right) shows pile-driving operations on fender structure.



ARTIFICIAL ISLAND (above) through which caisson is sunk is constructed with 46,000 cu yd of sand ballast from incoming freighters.

SECTION THROUGH VENTILATING BUILDING (left) shows position of steel caisson relative to other parts of structure. Space between steel walls of caisson is filled with concrete. Concrete, 18 in. thick, held by welded reinforcing, is poured against stepped-in upper part of caisson, keeping walls uniform to height of 85 ft.



CAISSON WITH ULTIMATE HEIGHT OF 85 FT (right) is built up of two steel plates 6 ½ ft apart for lower 51 ft, above which point plates step in 18 in. on outside wall. Double steel walls continue to total height of 75 ft above cutting edge. Single outer plate with steel column and beam construction forms top wall above double steel walls. In present stage of construction, concrete is being poured for lining of rock portion of shaft for ventilation structure.

CAISSON IS CONSTRUCTED ON SAND-FILL ISLAND

CONCRETE FOR FILLING CAISSON WALLS is mixed at job site using cement delivered by barge in air-activated containers. Working in cramped quarters calls for utmost efficiency in contractor's job organization.

EIGHT CONCRETE-FILLED CYLINDRICAL CAISSONS, sunk to rock, support parts of octagonal-shaped, 125-ft-wide ventilation building which extends beyond 51 × 111-ft steel caisson.

center as well as at the portals. An intake building is being constructed in Battery Place under which tunnel traffic will pass to the Manhattan portal. Stale air exhaust in Manhattan will be through a separate building, completely underground. The steel skeleton has been erected and some masonry placed for the 113 × 91 × 90-ft-high ventilation building at the Brooklyn portal.

Construction of the central ventilating shaft and octagonal building about 90 ft off Governors Island—a particularly interesting phase of the over-all project—is shown in the accompanying set of illustrations. The first step consisted of creating an artificial island as a base for succeeding operations. In the area where the island was to be made, silt, sand and glacial drift were dredged to a depth of 55 ft and filled with a 10-ft blanket of clay covered with 35 ft of sand. Then piles were driven in the form of an octagon, riprap was dumped around the piles, and additional sand fill was finally placed to bring the grade of the fill above high water. In the center of the island a 51 × 111-ft steel caisson having walls filled with concrete was sunk to rock to a depth of 70 ft by open dredging. Under compressed air the caisson was lowered until the cutting edge entered rock an average distance of 7 ft. The caisson, thus sealed by grouting to the rock, serves as the upper part of the ventilating shaft, the lower 63 ft being excavated from solid rock.

Eight concrete-filled steel shell cylinders 5 ft 6 in. in diameter, which were driven and jetted to rock, support the foundation steel of the octagonal ventilation building constructed on the concrete-filled steel walls of the caisson. These are sealed to the rock under air, and are extended into the rock by excavating a 25-ft-deep shaft.

Tunnel Excavation

Safety measures used in excavating the tunnels under the East River are described in a construction report of the project by Howard L. King, M. ASCE, in an article titled "Shield Used in Rock Tunnel Where Hazards Are Unusual," in the November 1946 issue of Civil Engineering. Mr. King is chief engineer for Mason and Hanger Co., Inc., New York, holder of one of the two largest contracts for the under-water sections of the tun-

(*Continued on page 82*)

CAISSON'S OUTER and cross walls are filled with concrete in 8-ft lifts by Pumpcrete machine set under mixer which is mounted on its own pile foundations.

Investigations Show Advantages of Extremely Wide-Angle Lenses in Aerial Mapping

VARIOUS TECHNIQUES have been used in attempts to reduce the variation of image illumination at different points in the lens field to obtain more effective exposure near the edges of a negative, but all methods have required special photographic manipulation. Recent investigations at the National Bureau of Standards by Drs. Irvine C. Gardner and Francis E. Washer have led to a more scientific and valid analysis of the causes of uneven negative exposure. A better understanding of such principles explains the discrepancies that other investigators have encountered in studying the variation of relative illumination from center to edge of the focal plane, and should aid materially in the design of photographic lens systems where even exposure is important. In particular, it puts the development of extremely wide-angle lenses on a sounder basis and points the way toward substantial savings in aerial mapping, an important application of photography in which additional manipulation is amply justified.

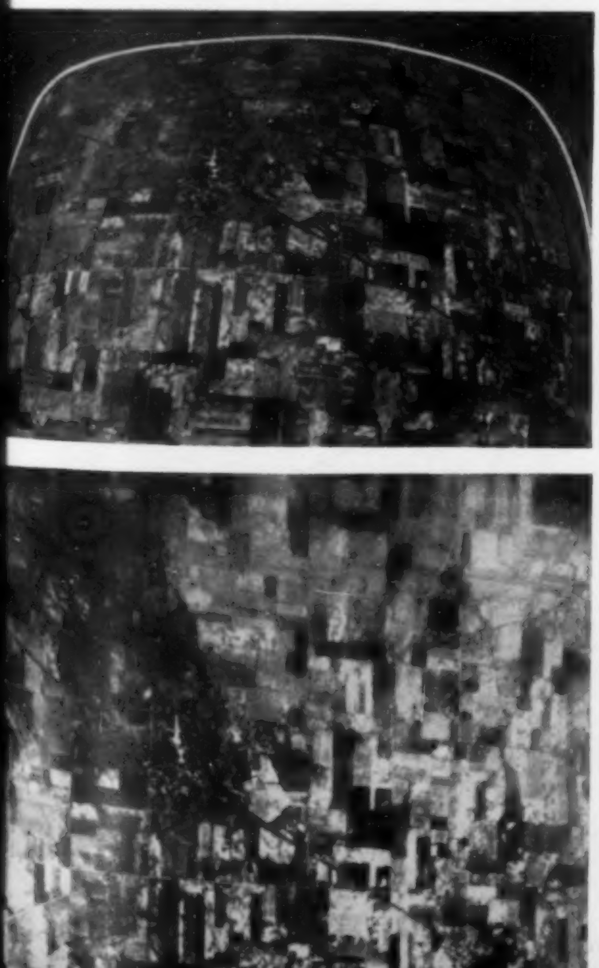
In the process of aerial mapping the elevations of points are determined by a stereoscopic method. Consequently, each point of the terrain must appear in at least two photographs, thus providing an image for each of the observer's eyes, a requisite for stereoscopic observation. In practice, as an airplane proceeds in a straight flight the exposures with a camera directed vertically downward are made at such intervals that two successive pictures overlap 60 percent in order to insure that each point will appear in two pictures. In making observations on a pair of photographs to determine contours or to determine the elevations of individual points, it is necessary that the photographs be carefully adjusted with respect to each other, a process termed orientation, in order that the values read from the plates may be correct.

Orientation is a difficult process requiring considerable time of skilled personnel. After it has been accomplished, observations can be made on but half of each photograph, because only those objects common to the two photographs can be measured stereoscopically. This process is one of the large costs in aerial mapping. It is evident that if a camera with a larger field of view is used, fewer photographs will be required to cover a given area, and the cost of orientation will be correspondingly reduced. Consequently, in aerial mapping there is a great economic urge toward the use of wide-angle lenses. Lenses with large amounts of distortion can be economically used provided they afford a markedly larger field of view.

Following the war American intelligence groups in Germany brought back German wide-angle equipment which made use of large amounts of distortion to obtain a wider field of view. The German lenses utilize a principle embodied in a patent by Dr. Gardner in 1936 and one which has not yet been applied by American industry. Although the focal length of the German lens, known as the Pleon, is only $2^3/_4$ in., the large outer lenses are approximately a foot in diameter with a field of view of 130 deg. (See illustration.)

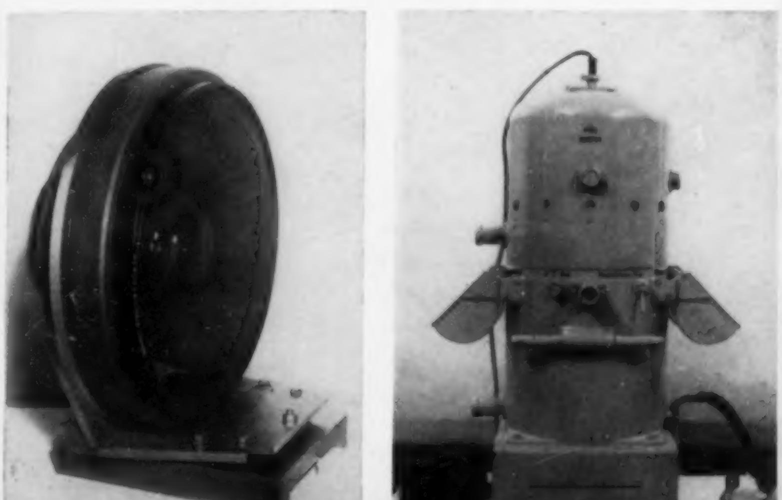
Distortion in the negative is corrected for projection or printing by a specially designed optical device, in

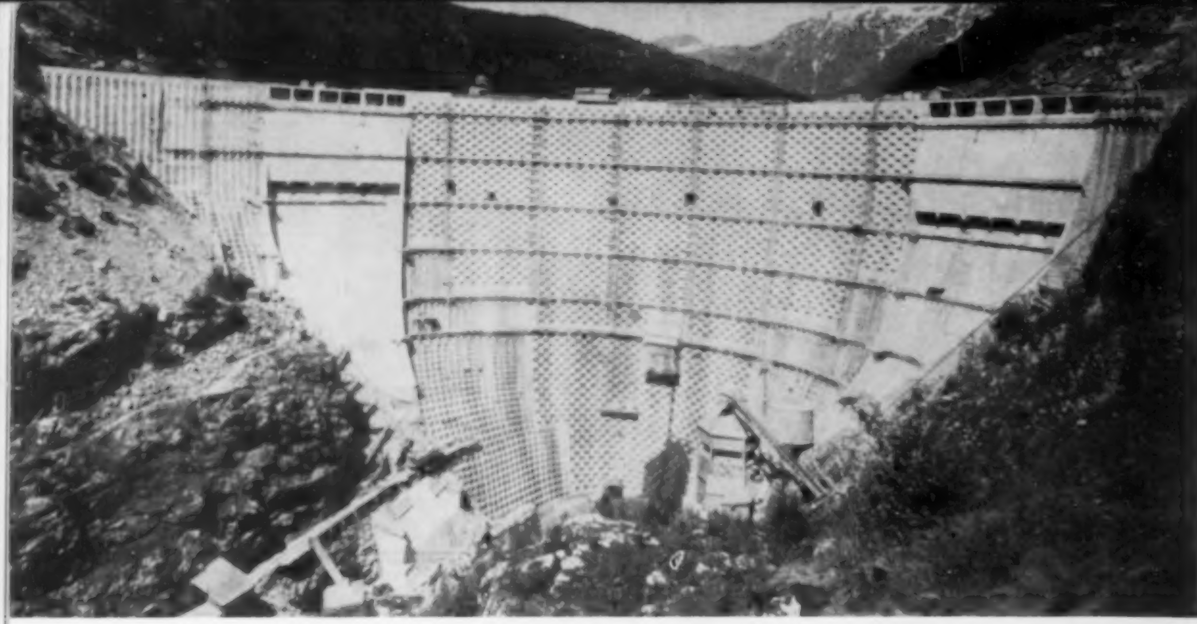
(*Continued on page 82*)



AERIAL PHOTOGRAPHS made with German Pleon wide-angle lens are characterized by pronounced distortion of image (upper view, at left) that increases toward outside edge. This effect is corrected for projection or printing (lower view, at left) by a rectifying optical system that introduces positive distortion; that is, marginal parts of picture are magnified more than center. (Photographs by USAF.)

PLEON WIDE-ANGLE LENS (below, left), used by Germans during World War II, makes use of large amounts of distortion to obtain wider field of view. Large outer lenses are approximately 1 ft in diameter. German rectifier (below, right) or copying device makes distortion-free print by optical projection from distorted negative obtained with Pleon lens. Film passes through instrument near center. Eyepiece (at center of instrument) is part of auxiliary system for centering negative.





KEY RECESSES IN DOWNSTREAM FACE of Ross Dam provide for raising structure to final height of 675 ft. Tests of concrete in first-step construction indicated height of second step (pictured here) could be increased 100 ft over originally planned 215 ft without thickening base. Finished structure will provide storage capacity of 3,400,000 acre-ft.

Modern Design Practice and Rigid Controls Produce Sound Concrete in Ross Dam

H. F. FAULKNER

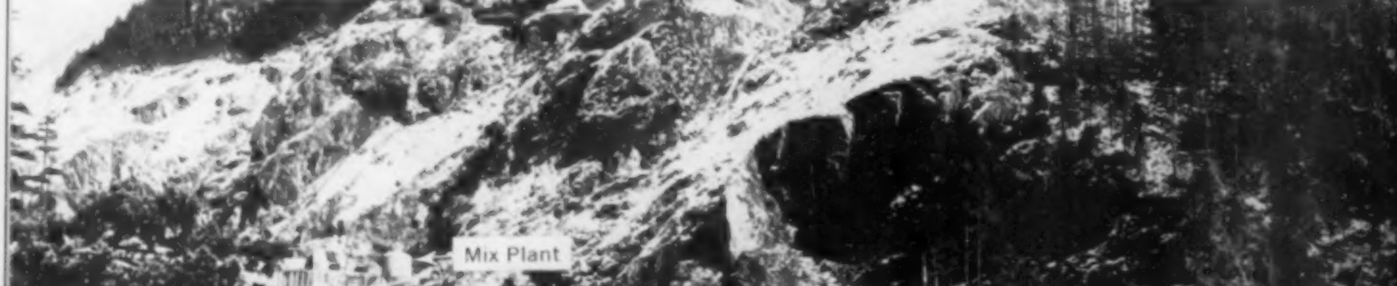
Formerly Resident Engineer, Ross Dam, Seattle, Wash.

ROSS DAM PLANT, the third unit in the City of Seattle's hydroelectric development on the Skagit River in northwestern Washington, is planned to develop 480,000 hp upon completion of the final stage of construction. At present the structure is 540 ft high with a crest length of 1,264 ft. Plans now being made for final construction call for thickening of the dam on its downstream face, where key recesses are provided, and raising the height of the structure to 675 ft. Modern practice followed in the design, placing and curing of the concrete, and the rigid construction controls maintained throughout the job are described herein. A paper on this subject was presented by the author before the Structural Division at the ASCE Summer Convention in Seattle.

THREE POWER PLANTS—Ross Dam, Gorge Plant and Diablo Plant—comprise the City of Seattle's hydroelectric development on the Skagit River in northwestern Washington. These plants with their impounding and diversion works are located in a long, narrow gorge that permits use of the water three times in a distance of 12 miles.

Gorge Plant, first and lowest of the three, completed in 1924, consists of a low temporary dam diverting water into a 2.1-mile, 21.5-ft-dia concrete-lined tunnel. The tunnel passes with a 275-ft fall through a mountain to the powerhouse, now developing 75,000 hp but having a planned ultimate capacity of 204,000 hp. Diablo Plant, the second of the three units, 7 miles above the Gorge Plant, consists of a 379-ft-high, constant-angle arch dam and a powerhouse at present developing 160,000 hp but having a planned ultimate capacity of 176,000 hp.

The Ross Dam Plant, the third unit of the group, located 5 miles above Diablo, is the key to the complete development of all three plants since, when finally completed, it will permit sufficient storage in addition to normal river flow to operate its own and the two lower plants at the full planned capacity during low river



flow in the dry summer months and during the winter freeze-up. The power plant for Ross Dam is planned to develop 480,000 hp.

Ross Dam was originally planned and designed to be built in three steps: the first to El. 1300, the second to El. 1515 and the third or finished dam, by thickening Steps 1 and 2, to El. 1728. The first step, completed in 1940, has its lowest foundation at El. 1075 and an extreme base thickness of 200 ft. Owing to a low contract bid and the availability of some additional funds, the first step was built with center sections to El. 1365 and with a wing wall to the abutments at both ends of the dam at that elevation, thus providing storage of 100,000 acre-ft. However, as power demands became more and more acute, it speedily became necessary to provide more power, which in this instance meant providing more storage. Therefore construction of the second step became imperative.

John L. Savage, Hon. M. ASCE, chief designing engineer of the Bureau of Reclamation, was engaged as consultant on the raising of the dam. Inasmuch as some doubt was felt as to the validity of the strengths obtained in the routine tests on the concrete of the first step, arrangements were made whereby the Bureau of Reclamation took 6-in. cores from the abutment rock and from the Class "A" and Class "B" concrete of the previous work.

Class "A" concrete, containing 1 bbl of cement per cu yd, was used throughout the main body of the dam. Class "B" concrete, a richer mix containing 1.3 bbl of cement per cu yd, was used in a belt 5 ft thick in contact with the foundation and abutment rock, and in layers 6 ft thick on the upstream and downstream faces of the dam. This richer concrete was not used on the downstream face above the first step. In the earlier tests, Class "A" cylinders had averaged 4,828 psi at 28 days and 6,776 psi at one year (Fig. 1); and Class "B" cylinders had averaged 6,639 psi at 28 days and 8,360 psi at one year.

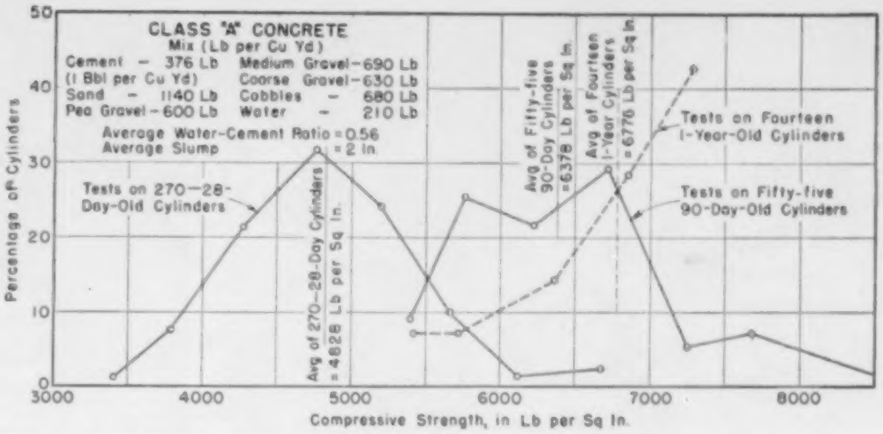


FIG. 1. TESTS on 28-, 90- and 365-day cylinders of Class "A" concrete in first-step construction of Ross Dam show average strengths of 4,828, 6,378, and 6,776 lb, respectively.

The cores obtained for the later tests, when taken to the Denver laboratory of the Bureau, were found to yield even higher strengths than had those in the original tests although the later cores had been cut through, and contained, aggregate ranging up to 6-in. maximum size. Both rock and concrete gave modulus of elasticity values in excess of 5,000,000 psi. As a result of these confirmatory findings, the proposed design of the second step was revised.

After new load analyses and stress determinations were made, Mr. Savage reported that without thickening the base, or first step, the height of the second step could safely be increased 100 ft, that is, from El. 1515, as originally planned, to El. 1615. Consequently, the first stage of the dam, now completed, has its roadway at El. 1615, with the spillway crest at El. 1582, where gates will be placed permitting water storage to El. 1600. At this elevation, it is feasible to install a power plant, which will be built in the near future.

In its present state, Ross Dam is 540 ft high with a crest length of 1,264 ft, providing 1,400,000 acre-ft of storage. Final construction of the dam, for which plans are now being prepared, contemplates thickening the dam on its downstream face, where key recesses have been provided, and raising the entire structure to El. 1750. The result will be an arch dam 675 ft high which will provide storage capacity of 3,400,000 acre-ft and will fully utilize the entire runoff of the watershed.

Concrete Specifications

The writer had the privilege of writing the specifications for the concrete as well as prospecting for and locating the best aggregate sources. As Engineer of Concrete Control on Step 1, and as Resident Engineer on the raising of the dam under Steps 2 and 3, he had, until his retirement, complete control of all concrete from the design of the various concrete mixes to their final placement and care in the dam. Under the City Light Department organization, the Project Engineer (not the Resident

CONVEYER LINE TRANSPORTS AGGREGATE needed for high-specification concrete at Ross Dam from shore to crusher, screening plant, classification bins and mixing plant. All aggregate used in dam is from Skagit River bars. Carload lots of cement arrive by barge across Diablo Lake, are transferred to shore rails and pulled by donkey cable up steep canyon wall, where contents are blown through suspended pipeline over outflowing stream to mixer.

TO ASSURE PERFECT BOND between monoliths, surface is thoroughly cleaned and 1/2 in. of bonding grout applied before concrete is poured. Grout stops and grout outlets are seen in face of hardened concrete of adjacent section. Cooling pipes are in place ready for pour.

BOTTOM-DUMP BUCKETS of 8-cu yd capacity transport concrete to all sections of dam by cableway. Aggregate is washed and concrete mixed with water of 50- to 60-deg temperature for cooling concrete. Pipes for internal cooling of concrete are seen in foreground of photograph.

Engineer) had general charge of the work for the owner; the Assistant Resident Engineer had charge of surveys, rock work, forms, grouting, and many other items of the work; and the Office Engineer handled estimates, time, quantities, and checked survey notes, etc. This arrangement permitted the Resident Engineer to devote much of his time to concrete operations.

Aggregate. Aggregate for all the concrete in the dam was taken from Skagit River bars. Tests of material from older deposits in alluvial and glacial benches along the river revealed that they contained small percentages of decomposed, laminated, and friable particles, and also that materials from such sources were rather angular in shape. Such material, caught in the swift waters of the river and passing through the 15-mile gorge, was completely ground up by the ball-mill-like action to which it was subjected. Only the structurally sound particles, subrounded and with not-too-smooth surfaces, survived for deposit in the bars from which they were taken.

Cement. All the cement used in Ross Dam was Type II, a type particularly well adapted to hydraulic structures and severe exposure. (See Table I.) Cement for the first step conformed to the ASTM Standard for Modified Cement; and that for the second and third steps followed the ASTM serial designation C 150-41 as applying to Type II, with alkalies of potassium oxide and sodium oxide restricted to not more than 0.6 percent. A mill on the Skagit River about 50 miles below the dam furnished the cement required for the project. This mill has always consistently produced a cement low in alumina, magnesia, and alkali, partly because of its large deposit of highly suitable lime rock and partly because of careful control and blending of materials from different parts of the quarry.

TABLE I. AVERAGE ANALYSIS OF TYPE II CEMENT USED IN ROSS DAM

Constituents	Percent
Silica	23.50
Iron oxide	3.20
Alumina	4.42
Lime	64.73
Magnesia	1.96
Insoluble residue	0.20
Sulfur trioxide	1.54
Ignition loss	1.00
Soda	0.16
Potassium oxide	0.21
$Na_2O + 0.658\ K_2O$	0.30
Potential Constituents	**Percent**
C_4AF	10
C_3A	6
C_3S	46
C_2S	32

Although the cement from this mill averaged high in quality, it displayed fluctuations in strength from time to time in the acceptance tests. These fluctuations undoubtedly contributed to variations in the strength of the concrete cylinders. However, changes in cylinder strength were less pronounced than changes in cement strength. Concrete strengths are evidently dependent on many factors besides quality of cement. The most marked and noticeable variation occurred in "bleeding." Under identical conditions of weather and concrete making, some shipments yielded surface water profusely while others bled not at all. Yet this cement is of excellent quality in the writer's opinion, based on 40 years of experience in testing and using a great number of cements, both foreign and domestic. It is his belief that further

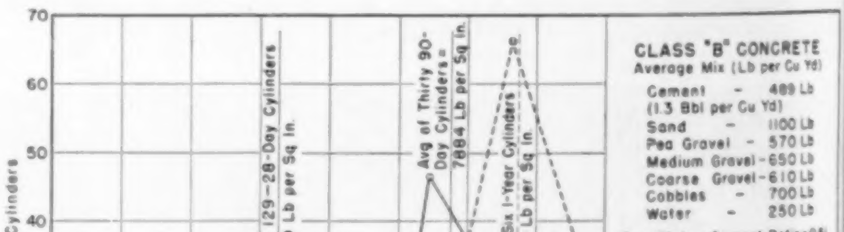


FIG. 2. TESTS for Class "B" concrete in first-step construction of Ross Dam show high average strengths of 6,639, 7,884 and 8,360 lb for 28-, 90- and 365-day cylinders, respectively.

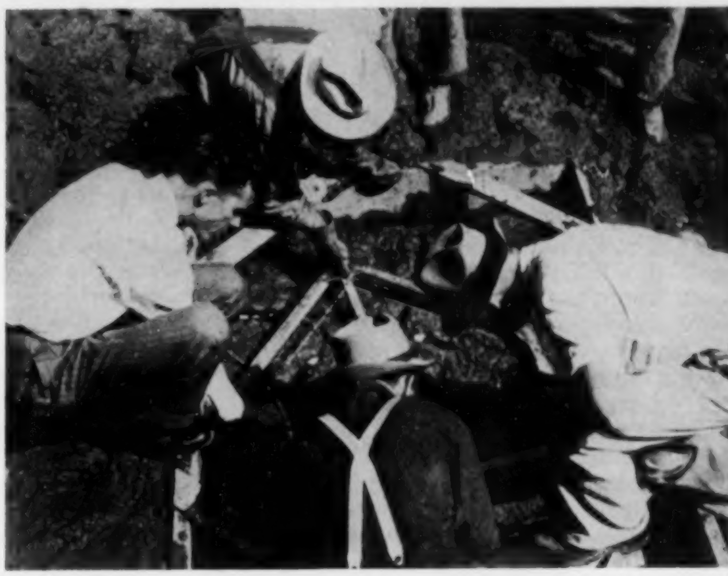
improvement in the production of uniformly sound concrete of high strength and durability is needed and that such improvement is to be sought through the manufacture of more uniform cements.

Choice of Mix and Production of Concrete

Before concreting began, many trial mixes were made, using aggregate of various gradations and the cement to be used in the dam. These mixes were tested for strength, workability and permeability, and only those which required the lowest water-cement ratio and which produced readily workable concrete were considered for adoption. The final conclusion was that with mixes containing 1 bbl of cement per cu yd and aggregate of 6-in. maximum size, a sand F.M. (fineness modulus) of 2.90 to 3.00 with approximately 18 percent passing the 48-mesh screen and 5 percent passing the 100-mesh screen, permitted the use of a water-cement ratio of about 0.54 by weight and produced good workability. Consequently this grading was adopted and closely maintained throughout the job. This grading was such that 1 percent was retained on the No. 4 screen; 15 percent on the No. 8; 36 percent on the No. 14; 64 percent on the No. 28; 82 percent on the No. 48; and 96 percent on the No. 100. The fineness modulus was 2.94.

Since the sand taken from the river bars was deficient in fines below the 28-mesh screen but had an excess of No. 4 to 1/4-in. material, some of the excess was passed through a ball mill and converted into the finer particles necessary to maintain the desired grading on the finer screens. Other classes of concrete with a higher cement content responded well to the sand grading selected for the mass concrete.

CONCRETE FROM BOTTOM-DUMP BUCKETS (above) cones as high as 4 or 5 ft before vibrating to 20-in. layers by means of two-man Chicago pneumatic vibrators.



BATTERY OF STRAIN METERS (right) is set in surface of pour as part of research work conducted on project. Roy W. Carlson, Assoc. M. ASCE (at left in photo), is research engineer in charge of investigations.

Tabulated mixes (Figs. 1 and 2) were closely adhered to, the principal adjustment being that slightly more sand and less pea gravel were used if the sand was coarser than F.M. 3.00, and less sand and more pea gravel if the sand was finer than F.M. 2.90, so as to maintain uniform gradation of aggregate. More tolerance was permitted in the three larger sizes of coarse aggregate in order to help balance the contractor's production.

Mix proportions conform closely to American Concrete Institute standards as outlined in the recommendations for the design of concrete mixes (A.C.1, 613–44), Robert F. Blanks, chairman. These standards are the clearest, most generally practical guide for the concrete producer with which the writer is acquainted.

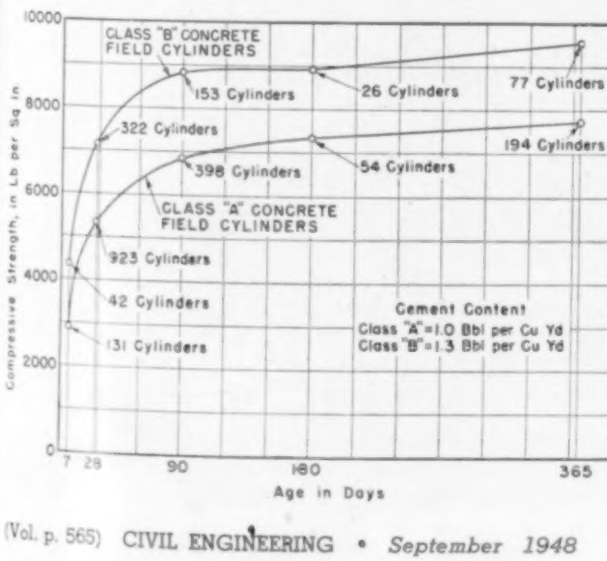
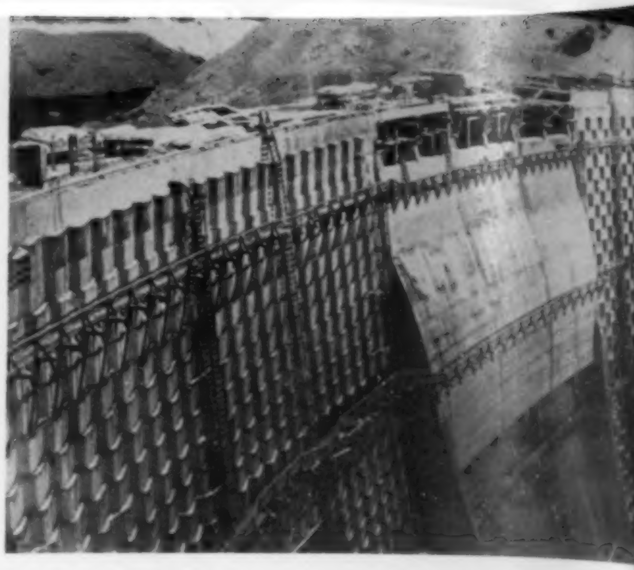


FIG. 3. HIGH STRENGTHS obtained in tests on Class "A" and Class "B" concrete cylinders in second- and third-step construction of Ross Dam indicate general excellence of concrete in structure.

Mixing Plant. Mixing was done in a plant consisting of two 4-cu yd Koehring mixers. Each size of aggregate, the cement and the water were weighed separately in Johnson automatic weigh batchers whose automatic graphic recorders gave a complete history of each batch. All operations in the plant were completely automatic except for an additional metered water supply which was operated manually for extra refinement in securing desired consistency in grout, special mixes and at the beginning of a pour. In such cases the water content was purposely kept low, and additional water was added only as the plant inspector observing concrete in the mixers indicated. Mixing time was $2^1/_2$ minutes. The ball-mill effect of $2^1/_2$ minutes in the huge mixers using up

TRAVELING HEAD TOWER for high-line cableway is seen above power tunnel intake in view of upstream face of dam.



DEFLECTOR HOODS at top of completed second-step construction are designed to train overflow into spillways at either end of dam.

to 6-in. aggregate was not too successful. However, there was some evidence that the sand quantity was somewhat increased while the fineness modulus was somewhat reduced.

Transportation. Mixed concrete from both mixers was dropped into a car, shunted about 100 ft across the left spillway section, dumped from the car into an 8-cu yd bottom-dump bucket, and transported to the various sections of the dam by the "high line." Generally, concrete dumped from the 8-yd buckets coned to a height of 4 or 5 ft. By proper vibration these piles could be densely placed and flattened into 20-in. courses in the lift without segregation. In topping out pours, around embedded features, along faces, or against abutments where Class "B" concrete was used monolithic with Class "A," it was frequently necessary to split buckets into two or more dumps.

For mass concrete, heavy two-man Chicago pneumatic vibrators were used. Smaller vibrators were employed where necessary. Spillway surfaces not only were vibrated but also were hand spaded a few inches away from the forms in order to liberate air bubbles.

Cleanup. Surfaces for bond were prepared by cutting off about $^1/_4$ in. of the surface with high-pressure air and water jets when it was possible to do so without disturbing embedded aggregate. Later these surfaces were washed with air and water two or three times until the concrete had thoroughly hardened in order to remove any loose cement that might remain partially set on the aggregate and matrix surfaces. Not until 72 hours had elapsed after placement was a covering pour permitted.

On concrete which had been placed seven days or more previous to covering with fresh concrete, it was frequently found that oil had been spilled or that the surface had become sawdust stained or had accumulated a slight film of calcium carbonate efflorescence. Such surfaces were wet sandblasted. All surfaces were thoroughly cleaned before the $^1/_2$-in. 1:2.6 bonding grout was broomed upon them.

Water Stops, Grout Stops, Drains, etc. A very effective seal was provided by the 10-in. copper waterstops which were half embedded in the surface of each 5-ft lift along the upstream face and which were buried by the following pour. For closing off the radial joints between adjacent sections of the dam preparatory to grouting, beaded copper grout stops were placed vertically across the upstream edge of the joints and horizontally at 50-ft vertical intervals. Beaded galvanized sheet-metal grout stops were used at the downstream face and on each side of the vertical 20-in. split porous drains between each section.

On line with these 20-in. drains, 8-in. vertical porous drains were placed at 10-ft intervals axially across each section and, like the 20-in. drains, extend from foundation to gallery and from gallery to top of dam. Below the gallery, 4-in. vertical pipes for foundation drainage holes were set midway between, and in line with, the 8-in. porous pipes.

Tests Show High-Strength Concrete

The concrete in Ross Dam was designed, placed, cured and generally controlled in close conformity with modern practice for such structures. To date, strength tests of approximately 2,500 cylinders from concrete in Steps 2 and 3 made at random by numerous inspectors, and many made by the writer in instructing inspectors, have shown an average strength for Class "A" concrete of 5,380 psi at 28 days 7,350 psi at 90 days, and 7,645 psi at one year. For Class "B" concrete the average strengths were 7,035 psi at 28 days, 8,790 psi at 90 days and 9,100 psi at one year. Based on the one-year strength of Class "A" concrete only, these tests show a factor of safety of 8 in the dam, including earthquake effect. With Class "B" concrete used against abutments, the points of highest stress, this factor is probably somewhat higher than 8 (Fig. 3).

Factors contributing to the high strength, the comparative freedom from cracking, and the watertightness of the concrete are:

1. Careful Design of Mixes. The mixes were designed to produce best results with the cement and aggregate used, then were closely adhered to throughout the job.

2. Well-Graded Aggregate. Sound aggregate, clean and effectively graded was used. Sand, the most influential aggregate in the concrete, was purposely kept as coarse and as small in quantity as was consistent with good workability and with keeping the water requirement as low as possible. The water-cement ratio averaged 0.54 by weight for Class "A" concrete and 0.45 for Class "B."

3. Cool Concrete. Concrete was kept cool by the use of fresh cold water, washed aggregate and by mixing the concrete with cold water of which the average temperature at placement ranged between 50 and 60 deg F, with the highest recorded at 66 deg F. Concreting was suspended during cold weather when the temperature fell to 26 deg F or lower. Hot water only was employed to raise the concrete temperature to 50 deg during cold weather placement.

4. Thorough Curing. Concrete, after it had attained sufficient set, was continuously hosed with cold water on all horizontal surfaces, and sprayed with cold water through

perforated pipes on all vertical surfaces, until covered with fresh concrete regardless of the time interval. This practice provided ideal curing and dissipated hydration heat more effectively than ponding or a wet sand covering; it also helped greatly in keeping surfaces clean for future bond.

Internal cooling of the concrete was used in Steps 2 and 3, but not in Step 1, the bottom and thicker part of the dam. Practically no cracking occurred in either part. However, regulated cooling has become standard practice in massive structures and under unfavorable conditions is undoubtedly highly valuable. Temperatures taken in thermometer wells and recorded by the many embedded instruments rose as high as 100 deg F in Step 1 without cooling pipes, but in Steps 2 and 3, with cooling pipes, only in a few instances was the temperature permitted to rise to 90 deg F. Mixes were so closely controlled and ingredients so closely proportioned that the theoretical concrete output at the plant checked later computed cross-section quantities within $^1/_4$ of one percent.

5. **Rigid Control.** Development of sustained interest in inspectors is a highly important factor in the production of good concrete. Inspectors were urged to take a diligent interest in their work, to study, discuss and suggest better ways of doing it; to explain, in giving orders necessary to enforce specifications, why the work should be done in the required manner, what the desired results were, and also what the results would be if the work were done in the wrong way.

A slackening in effort and enthusiasm is likely to occur on long jobs as the work becomes routine and monotonous. The supervising authorities made every effort to keep enthusiasm alive by themselves maintaining unflagging interest in the work and in their inspectors. There was competition among the mixing-plant inspectors, as to who could get the best results with the least errors, and among the placement inspectors, as to who could get the best consolidated and shaped surfaces. Rock or gravel pockets became inexcusable. The curing inspectors gave each other h--- if any dry concrete was found. Inspectors who failed to show enthusiastic effort or who did not possess the faculty for getting along efficiently and peacefully, were not retained.

Throughout the construction of all three steps of the dam, friendly cooperation was maintained between the contractor's and the owner's organizations. Mandatory or dictatorial orders by inspectors or engineers were forbidden and any serious disputes or disagreements were referred to the Resident Engineer or to the Assistant Resident Engineer for adjustment. All work methods and procedures were planned ahead and were discussed with the contractor in advance. Therefore, few sudden changes that would inconvenience him or give him cause for complaint had to be made. Mutual respect for each other's rights was strictly observed. Cooperation by the contractor was another most important matter. The contractors were as

(*Continued on page 82*)

MAZE OF REINFORCEMENT in trashrack structure dictates use of pours with small-size aggregate and high cement and water content, thus increasing difficulty of placing high-quality concrete.

Welded Units Provide 13,000,000-Gal Oil Storage Tank

ALL-WELDED RECTANGULAR TANK covering entire New York City block has storage capacity equal to full load of ocean - going oil tanker. Said to be largest in country, 13,000,000 - gal tank measures 200 x 300 x 30 ft high. Structure consists of 2,000 tons of sheet steel largely prefabricated into panels and erected on site. J. K. Welding Co. of Yonkers, N.Y., constructed tank for Petroleum Terminal Oil Corp. in five-month period. Photo courtesy The Lincoln Electric Co., Cleveland, Ohio.

BEARING VALUE OF UNDERLYING STRATA is determined through use of conventional pile driving equipment. Shown here is "Button-Bottom" pile in which precast concrete point closes end of drive casing. Core inside casing, bearing on point, can be loaded with weight of rig to make test on point alone. Cylindrical shell of constant diameter for its full depth is lowered inside casing, attached to driven point and filled with concrete, then casing is withdrawn. Photo courtesy Lone Star Cement Corp.

Pile Tests for Design and Construction Economy

H. B. THORNLEY

Assistant General Superintendent, Western Foundation Corp., New York

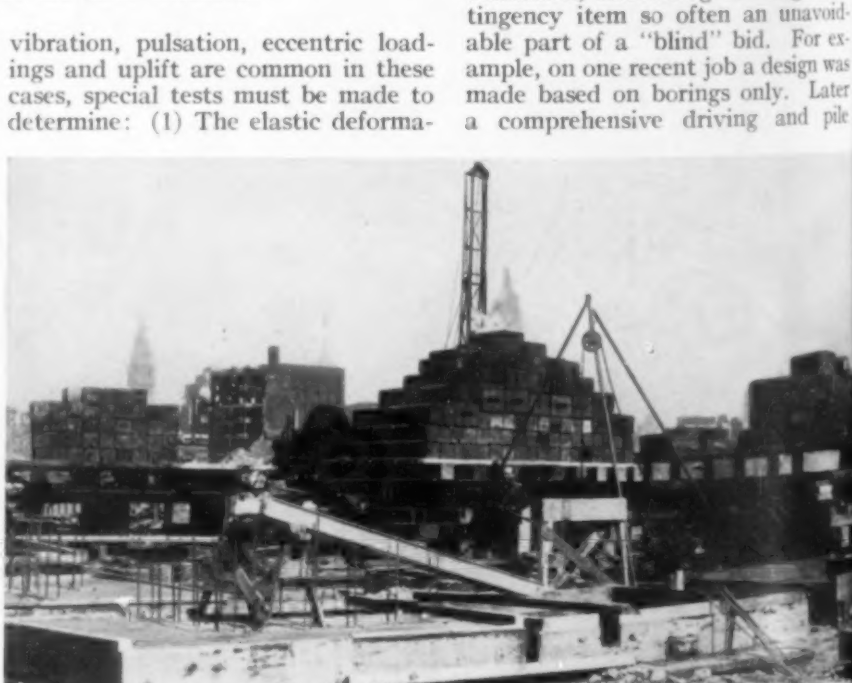
NEED FOR AN INTEGRATED and comprehensive program of test loading in connection with major pile foundation projects is rapidly being realized by engineers and architects throughout the country. Expenditures for foundations of structures can be kept to a minimum by tests to prove the actual behavior of piles under conditions that prevail at the site. Still further savings frequently can be made by load tests on the type of pile finally selected (by bidding or otherwise) and replanning in accordance with test results for full utilization of the bearing value of the actual pile as driven. However, these tests must be made prior to or in the earliest stages of construction. Late tests may only raise doubts or regrets, with little opportunity to take advantage of the data obtained.

INFORMATION GAINED from comprehensive programs of test pile driving prior to final design and start of construction on major structures generally will save many times the cost of testing. The information desired will vary considerably.

In the design of foundations for heavy tools and large machines (such as turbines and generators), even minute amounts of differential settlements must be eliminated. Since vibration, pulsation, eccentric loadings and uplift are common in these cases, special tests must be made to determine: (1) The elastic deformation for different materials, lengths and shapes of pile shaft; (2) the percentages of the load carried by end-bearing and by friction; and (3) the resistance to various stresses such as uplift and vibration.

The Pre-Design Program

The Pre-Design Test Program is to determine the type or types of piles that will best fulfill the design requirements and provide the most economical structure. Such a test program can be utilized to save many times its cost by acting in two ways: First, it enables the engineers to know and specify the correct type of foundation for the particular job. Second, by use of the records of the tests the contractor can make an accurate and close bid based on the conditions that will actually be encountered, alleviating the large contingency item so often an unavoidable part of a "blind" bid. For example, on one recent job a design was made based on borings only. Later a comprehensive driving and pile



PILE TESTING PROGRAM, early in construction operations at Stuyvesant Town Housing Development in New York City, proved far more dependable criterion for determining bearing capacity of piles than that provided by driving formulas. Knowledge of pile behavior gained from these tests permitted changes that resulted in substantial savings to owner.

PIPE PILE, of $10^3/_4$-in. outside diameter and 120-ft length (above), safely supports directly applied load of 420 tons. Note rigging to permit tilt of load by holding sides down rather than conventional wedges under load, which might distort results.

TESTED TO DESTRUCTION, 12-in. 53-lb H-piles 116 ft long (below) failed as short columns above ground. Heavy test load did not injure piles below ground surface, despite 40-ft depth of soft mud through which pile was driven to firm material.

load test program was carried out at a cost of about $30,000. On that basis a new design was made, the net saving of which was about $300,000.

Most engineers recognize the value of the pre-design test program and are using it increasingly where there is doubt about the bearing value or behavior under load of any soil or pile; but few engineers take full advantage of the knowledge gained from tests performed at the start of construction.

The Pre-Construction Program

The primary purpose of pre-construction testing, as now done, is to prove the ability of the particular pile offered by the successful bidder to support a specified load and not exceed a permissible settlement. If the pile meets the conditions imposed it is accepted as satisfactory. No credit is given for substantially better than minimum performance.

It is where *substantially better* than minimum performance is shown by loaded piles, that opportunities for increased economies exist. It sometimes is possible to effect considerable additional savings in both time and money by using the higher loads *proved* by extensive pile tests rather than loads permissible under formulas based on driving resistance only. Such additional loads can be allowed only when a large number of both individual and group pile tests show a high safety factor.

An interesting illustration of the actual money savings from extensive pile testing, is the work performed at the Metropolitan Life Insurance Company's Stuyvesant Town Housing Project in New York City. The bid for more than 35,000 cast-in-place concrete piles was based on a specified length of 35 ft. As the job progressed it became evident that, to reach a penetration that would indicate a safe bearing of 30 tons, according to the *Engineering News* Formula (as set up in the New York City Building Code), many piles would exceed 80 ft, and some would exceed 100 ft in length (*Engineering News-Record*, Feb. 5, 1948).

A series of such tests made by order of the builder and the owner, indicated that the actual bearing value of the piles being used was far in excess of that indicated by the formula. On the basis of the tests, a special directive was issued by H. V. Spurr, M. ASCE, chief engineer for the builder, permitting the full 30-ton design load to be carried on piles that in some cases would have been good for less than 10 tons under the *Engineering News* formula. The piles driven on this job, and proved by the tests, were the "Button Bottom" type with a cylindrical shaft and had a high factor of safety in the sandy soil into which they were driven.

A point that often is overlooked when planning test programs is the extreme importance of making the tests during the early part of the job. This vital point would seem obvious, but it is missed with amazing frequency. Pile tests made at the start of a job will indicate whether or not the type of pile being used is suitable for conditions encountered and will indicate the load that can safely be used. Tests made toward the end of a job are valueless—since it is too late to use the savings indicated by a good test or to take the corrective action indicated by a bad one.

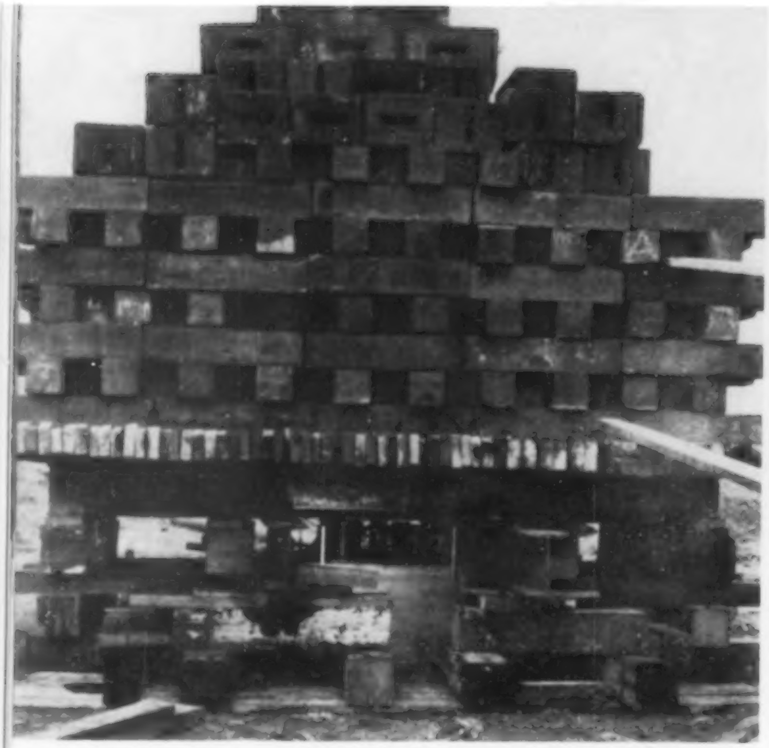
Technique of Pile Testing

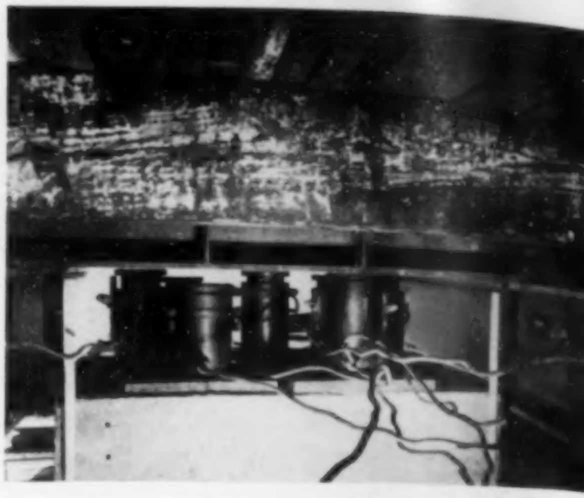
The rig used by the Western Foundation Corp. usually consists of a set of steel leads, about 90 ft high, which are erected on one end of a steel bedframe with a steam boiler and hoist placed at the other end. The boiler provides steam for operating the hoist and the pile hammer. A relatively heavy single-acting steam hammer is used (20,000 ft-lb or more) since lighter hammers tend to distort the driving results.

For cast-in-place concrete piles a hollow cylindrical drive casing (14-in. outside diameter in lengths up to 75 ft) is most useful for many tests. By employing two pairs of five-sheave blocks and eleven parts of cable, a pull of up to 80 tons may be exerted for the purpose of removing the casing from the ground.

Using this equipment, it is possible to drive any type of pile that may be required. However, for the "special tests" described here a type of cased cast-in-place concrete pile known as the Button Bottom pile has been used.

In driving a cast-in-place pile of the Button Bottom type, the lower end of the drive casing is placed on an unreinforced precast concrete button as shown in an accompanying illustration. Contact between the button and the driving casing is made through a coned, alloy steel driving collar (to prevent shattering of the button resulting from the driving impact). The casing is driven to the required depth, the concrete button acting as an enclosure to keep all water and foreign material out of the casing. A $12^3/_8$-in.-dia spirally corrugated steel shell is lowered into the casing, the lower end of the shell being locked onto the concrete button. The casing is withdrawn and the corrugated shell filled with concrete.





SEVEN HYDRAULIC JACKS reacting against 300 tons of caisson weights (left) cause only $^{11}/_{16}$-in. settlement of four pedestal piles driven through mixed ground to depth of 40 ft. Hydraulic jacks, shown in close-up view above, permit close control and rapid variation of total load.

With the equipment and method of driving outlined, it is possible to make several tests which will, when considered with the driving record, give an accurate picture of the subsurface conditions. Of first importance is the test for bearing value of the soil *in place*, and under its natural head or pressure at any given depth.

This bearing value can be determined directly by the use of a close fitting core inside the casing. After the casing and concrete button have been driven to the desired depth, the core is lowered into the casing so that it rests upon the button. Since the core is not in contact with the casing at any point, and the button is not attached to the casing, but merely contacts it through an outwardly sloping surface, any load placed upon the core will be transmitted directly through the button to the soil. The area of the plug being known, the bearing value of the soil in place can be computed accurately. Frequently there is a surprising difference between this "in place" value and the so-called undisturbed sample compression value as shown by laboratory test.

Test for Frictional Value of Soil

While different types of piles may have different frictional values in any given soil, it is possible to find the percentage of the load that is carried by friction (where the contact is between smooth steel and soil). By using this figure and comparing it with data available from tests of other surfaces, it is possible to arrive at a relatively accurate figure for friction. In some cases soil shear, not friction, will be the governing factor.

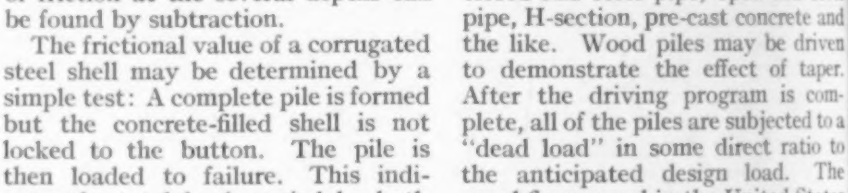
The frictional value of a smooth steel cylinder against soils at various depths is ascertained by introducing a calibrated hydraulic gage into the pulling gear described. Since the magnitude of friction is not affected by "direction," the pull necessary to start upward movement of the casing from various driven depths will indicate the total friction at these depths. From these test data the increment of friction at the several depths can be found by subtraction.

The frictional value of a corrugated steel shell may be determined by a simple test: A complete pile is formed but the concrete-filled shell is not locked to the button. The pile is then loaded to failure. This indicates the total load carried by both end-bearing and friction. Next, an uplift load is applied to the shaft (shell and concrete). Since the frictional value is the same regardless of the direction in which it is exerted, an approximate value will be indicated when the weight of the pile is subtracted from the pull.

It should be noted that the term "frictional value" with relation to a test on corrugated shell pile is somewhat inaccurate. The soil fails in shear along the line of the high ridge of the corrugations, except where uplift is applied to a tapered pile.

In a major test program, additional types of piles are driven, such as closed-end steel pipe, open-end steel pipe, H-section, pre-cast concrete and the like. Wood piles may be driven to demonstrate the effect of taper. After the driving program is complete, all of the piles are subjected to a "dead load" in some direct ratio to the anticipated design load. The usual figure used in the United States is 200 percent of design load.

Load tests usually are applied in increments, and the pile allowed to come to rest after each additional increment. The load may be applied by simply placing it directly on top



SLIDING CANTILEVER LOAD provides large variable load for testing piles. Forward end of cantilever beam is held down by three piles driven to resist uplift. Photo courtesy R. D. Chellis, M. ASCE.

of the pile, but it will be found that the use of a hydraulic jack, acting against either a dead load or a cantilever reaction pile combination, is the more efficient method. A "pedestal" pile in which a bulb is formed at the base by forcing concrete out from the bottom of the pile is the best type to use for reaction purposes.

When loads are applied by hydraulic jacking it is possible to perform the PULSATED LOAD TEST. In this test, after the pile has come to rest under the initial dead load, the total load is reduced to zero and returned to the maximum in a short cycle lasting not longer than two minutes. This cycle is repeated regularly, increasing the total load each time. This type of test is particularly valuable when the pile is in a clay stratum, as the pulsating motions will frequently indicate a dangerous "puddling" action that would not show up in the slow "increment" form of the standard load test.

The final test, and incidentally one of the most severe, is the VIBRATED LOAD TEST. In this test, when the pile has come to rest after the final increment of the dead load has been applied, a vibrator is attached to the pile and the pile is vibrated under load for varying periods. The vibrator generally used is a heavy, eccentrically mounted wheel driven at varying speeds in the range of 300 to 1,000 rpm by gasoline or electric motor.

A "Pre-Design" test program recently carried out by the Stone & Webster Engineering Corp. for the General Electric Co., at Schenectady, N.Y. (CIVIL ENGINEERING, May 1948), provides an excellent example of a carefully planned and well-thought-out test operation.

The building under consideration is to be used for the construction and testing of steam turbines and will be subject to high concentrated loads, attended by a considerable amount of vibration. The site is over an old river channel and, with the exception of a strata of sand and gravel about 55 ft below the surface, has poor bearing material down to the surface of the hardpan some 90 to 115 ft below ground level. To assure the absolute minimum of settlement, the writer's company was ordered to drive and test a series of H-beam, closed-end pipe, cast-in-place concrete pedestal piles and Button Bottom piles. The H-beam and pipe piles were to bear on rock, and the concrete piles were to be driven into the sand and gravel strata (*Engineering News-Record*, May 13, 1948.)

These piles were subjected to the various tests described in this article, and of all the piles tested, only the pedestal type showed no settlement under any form of test load. The subsequent foundation design was based on the use of a combination of pedestal and H-section piles.

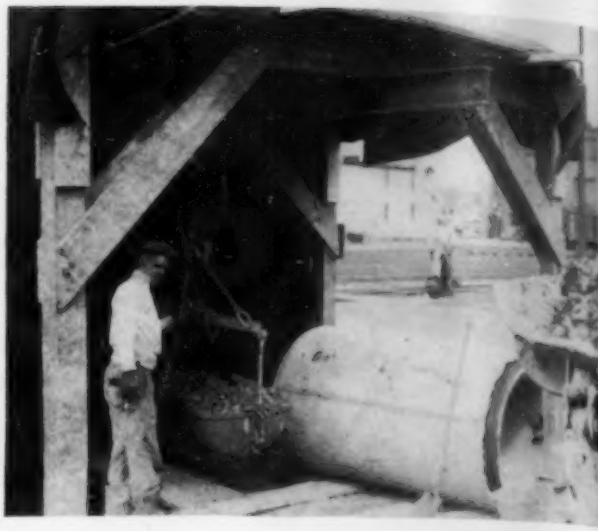
The cost of an intensive pile test program will be more than offset by the savings indicated in the foundation design, and in the elimination of contingencies. These factors, combined with the additional information that can be obtained through the newly developed testing techniques make an exploratory program a must for major projects.

"DRIVEN-CORE" COMPOSITE PILE (in which 8-in. 40-lb H-section is driven through already placed shell so that upper ground friction is avoided) is shown under heavy test load at Staten Island Ferry Terminal in New York City.

Truck-Drawn Machine Smooths and Finishes Concrete Pavement

JOB-BUILT RIG for smoothing and finishing freshly laid concrete road surfaces consists of 13×20-ft framework which is dragged over pavement by truck operating alongside. Series of rubberized beltings on framework strike fresh concrete to correct grade and at same time remove excess laitance and bleeding, while burlap sacking attached at rear applies pavement finish. Rig eliminates no existing operation but provides procedure which leaves finished pavement surface. Built in shops of Virginia State Highway Department, device has been successfully demonstrated on U.S. Route 60 east of Richmond. Developer Rayford R. Dawson, engineer-inspector of Department, plans eventually to construct it on motorized frame, eliminating truck.

FIRST STEP IN PIPE-JACKING job is digging of pit 25 × 15 ft and 17 ft deep in which jacking equipment is placed. Heavy timber framework over top of pit carries monorail directly over center line of pipe for operation of chain hoists used in removing spoil and lowering 36-in.-dia pipe sections.



SPOIL IS REMOVED in small cart with rubber-tired wheels and removable trough-shaped body. Full cart body is raised to surface by chain hoist for dumping, while empty body in pit below is substituted on cart chassis and rolled back into pipe. Monorail carries trough beyond pit area for dumping.

Job-Built Rig Jacks 123-Ft Length of 36-In. Pipe Under Railroad Right-of-Way

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JACKING WAS recently employed successfully in placing a 36-in.-dia sewer pipe under the main line of the Chicago and Northwestern Railroad in Ames, Iowa. Although the specifications required that tunneling extend 5 ft beyond the outside pair of tracks, or a minimum distance of 114 ft, the actual length of pipe driven totaled 123 ft. The contractor, Clinton Engineering Co. of Clinton, Iowa, designed and built the jacking rig and prepared the working area in such a way that the entire operation proceeded smoothly and quickly, requiring but ten two-shift days. Gus K. Ladehoff, superintendent on the job, was responsible for the design of the equipment and supervision of the work.

TO AVOID DELAYS TO TRAFFIC at an eight-track crossing on the main line of the Chicago and Northwestern Railroad in Ames, Iowa, jacking was utilized to extend a 21-in. sewer pipe-line under the railroad right-of-way. The contractor elected to use a 36-in. reinforced concrete pipe, the smallest size in which a man can efficiently work, and to concrete the invert to give the same section as the 21-in. line (Fig. 1). Concreting of the invert permitted compensation for any slight errors in grade and alignment that might occur in jacking the 36-in. pipe into place under the railroad tracks. The invert of the 21-in. line is at an average depth of 13 ft below the roadbed, which is on grade with the surrounding area.

Pit Constructed for Jacking Rig

A pit was dug at the downstream end of the pipe crossing from which all work of jacking was to be done. The pit was completely timber sheathed and was bridged by a heavy timber framework to carry a monorail directly over the center line of the pipe for the operation of the chain hoists. The framework was covered with canvas to keep out the rain and

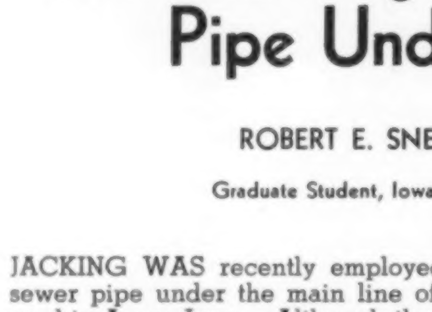

FIG. 1. CONCRETE FILLER SECTION, 7½ in. thick, is added to invert of 36-in. pipe to provide same low-water velocity and other characteristics as 21-in.-dia line with which larger pipe connects.

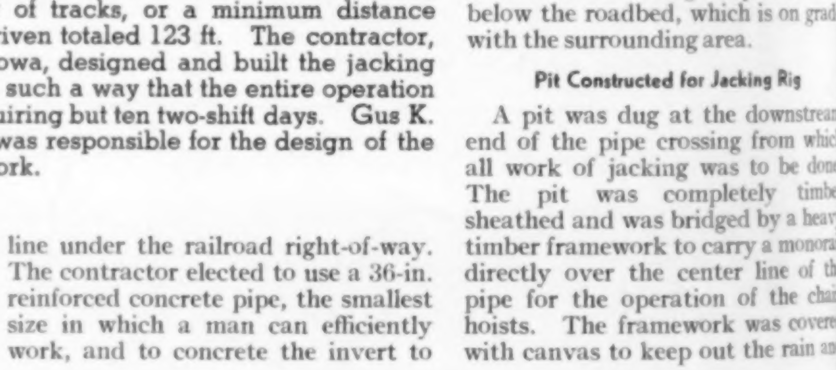

FIG. 2. SIDE ELEVATION OF PIPE JACKING RIG shows 8-in. I-beams which transmit force of two horizontally-mounted 100-ton jacks to timber buffer resting against pipe end. To right of jack is 8-in. I-beam which presses against 12×12-in. blocking and transmits thrust to back wall of pit.

snow of early spring. The monorail projected beyond the excavation to permit dumping outside of the pit area.

In the bottom of the pit, a 6-in. concrete working platform approximately 15×17 ft was laid to support the jacking rig. The slab was finished at proper elevation and slope for the pipe cradle. Since the floor of the pit was continuously water soaked, extreme difficulty would have been experienced in maintaining jacking-rig line and grade without a rigid concrete platform. A sump in one corner of the pit collected the water that seeped in during the jacking operation.

When jacking was ready to begin, a slight excavation was made in the face of the pit, the first section of 36-in. concrete pipe was lowered into place, and pressure was applied. No special cutting edge was used. One man crawled inside the pipe and excavated the face with a pneumatic spade. At first the excavation was carried about 12 in. ahead of the pipe, and then the pipe was jacked forward. But with increased experience and proficiency, the two operations of excavating and jacking became almost continuous, for the man at the face of the excavation was able to keep just ahead of the men who were jacking and shifting the blocking.

ONE-TON ELECTRIC CHAIN HOIST lifts yoke carrying small cart body to surface where it is rolled on monorail to dumping area. Cart body, specially designed for removing spoil from 36-in. pipe, is steel trough 27 in. wide at top, 48 in. long and 13$^1/_4$ in. deep.

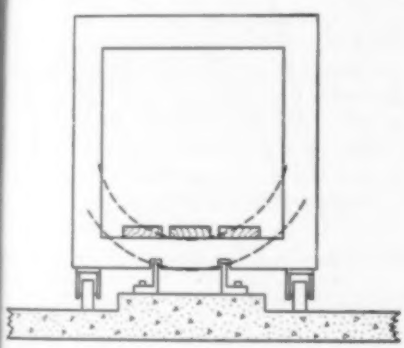

FIG. 3. ELEVATION OF PIPE END of jacking rig shows notches which fit over angle-iron track and keep entire assembly in perfect alignment. Outline of pipe section indicates how pipe rests firmly on rails to insure correct grade and alignment.

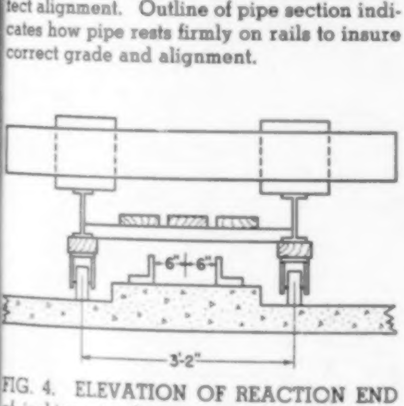

FIG. 4. ELEVATION OF REACTION END of jacking rig shows arrangement of 8-In. I-beams with jack bearing plates attached for transmitting jacking pressures through blocking to back wall of pit.

The jacking rig itself advanced, guided by angle-iron rails, as it pushed the sections of pipe forward. After each 12 in. of movement, another 12 in. of blocking was placed between the two 100-ton hydraulic jacks and the back wall of the pit, and the operation was continued. When a 6-ft section of pipe had been pushed completely into the right-of-way subgrade, the blocking was removed, the jacking rig was rolled back, and the next section of pipe was lowered into place. The hand-operated pumps were placed on the jacking rig, directly in front of the jacks, so that pumps and men rode forward as the assembly moved. A side elevation of the jacking rig appears in Fig. 2, and elevations of the pipe end and the reaction end are shown in Figs. 3 and 4.

The material through which the pipe was placed was the typical blue-gray "C" horizon glacial till with a gravelly sand admixture. The material was relatively dry but water seeped into the face of the excavation continuously. Although in this region the presence of glacial boulders or erratics might have been expected, only one small boulder of about 14-in. diameter was encountered. It gave no trouble.

Best results were obtained by excavating to slightly less than the periphery of the pipe and allowing it to shave the hole as it was pushed forward. When the pipe moved out of alignment, which was accurately checked by surface borings, more material was cut away on the side of the pipe toward which movement was desired.

A second man, working at the head of the pipe directly behind the first, used a short-handled shovel to load the spoil into a small rubber-tired cart which was easily moved in and out of the pipe. When the cart was filled with spoil, it was pulled out of the pipe where a yoke was fastened to the cart body so that a one-ton electric chain hoist could lift it to the surface for dumping.

Jacking Pressures Measured

To obtain data on the magnitude of the pressure required to push the pipe through the glacial till, hydraulic pressure gages were mounted on the jack pumps. Until the pipe in the excavation reached a length of 40 ft, the pressure was too small to measure with the equipment used. With 40 ft of pipe, the pressure measured 16 tons per jack, or a total of 32 tons against the pipe. The last readings made, with 123 ft of pipe in the excavation, gave a pressure of 57 tons per jack, or a total pressure of 114 tons on the pipe.

The rate of jacking was influenced only by the pumping time, and not by the pressure required, except for the fact that the men doing the pumping became fatigued more quickly when pumping against the higher pressures. The average rate of movement during actual jacking was 0.6 fpm. The average total movement per shift was 6 ft. Ten two-shift days were required for the operation, from the time jacking began until the final station was reached.

Proposed Allegheny-Genesee Waterway Links Vital Inland Water Systems

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RAIL TRAFFIC to eastern New York State and southern New England can avoid the traffic congestion of the New York district only by routing shipments on railroads crossing the Hudson River further north. With the completion of the proposed Allegheny-Genesee Waterway, all railroads crossing the Hudson River can have river-rail terminals for the transfer of commodities hauled by barge to and from the Ohio and the Mississippi rivers. The new waterway will create a direct barge canal between the Gulf Intra-Coastal Canals and the Mississippi River in the south and the New York State Canal System in the north, with access to the Great Lakes and the Eastern Seaboard. Through this canal a major portion of the 83,000,000 tons of bituminous coal and petroleum products, an unestimated tonnage of iron and steel, and immense tonnage of numerous other commodities, will seek transport. The limited traffic studies considered in this review show that sufficient trade between the regions north and south of the waterway already exists to justify the new facilities.

ALTHOUGH IMPROVED for and now hauling heavy freight, the inland waterways carry only a small part of the potential tonnage that seeks transportation through the Allegheny-Genesee Waterway. The new channel of commerce will carry tonnage, and the consequent transportation benefits, of traffic now moving by other means and of traffic to be created by low-cost transportation.

The increased cost of railroad service in recent years has given renewed emphasis to the advantages of water transportation and has directed attention to establishing the best balance between rail and water traffic. A large proportion of bulk commodities, such as fuel and raw materials for manufacture, in which low freight rates are more important than rapid movement, is adapted to water traffic.

The effect of the waterway will accrue directly and indirectly to sections of the country remote from the waterway, including areas on the tributaries of the Mississippi System and areas on the Canadian navigable rivers and the Great Lakes.

Before the railroad era, the Allegheny River and the Genesee River formed a waterway connecting the Ohio River at Pittsburgh, Pa., with the New York State Canal System at Rochester, N.Y. The Allegheny River has its source in the extreme northeasterly section of the Mississippi River watershed. It is the only natural waterway available for extension of the Mississippi inland waterway system to the greatest industrial state, New York.

The Allegheny-Genesee Waterway will open a new channel for the interchange of commerce between the region of greatest production of raw and intermediate materials and the region of greatest production of finished products. The large and continued increase of water-borne tonnage in the Pittsburgh district is evidence of what may be expected when navigation improvements penetrate the deposits of natural resources in the Allegheny Valley.

The great volume of water-borne commerce on the Great Lakes, the Ohio and Mississippi Rivers, the improved parts of the Monongahela and Allegheny Rivers, and the New York State Canal System, between local as well as distant points, indicates the immense tonnage that will seek transport through a barge canal connecting the Allegheny River and the New York Canal System. Waterway distances from Pittsburgh are as follows: to East Brady, Pa., 72 miles; to Oil City, Pa., 134 miles; to Warren, Pa., 192 miles; to Olean, N.Y., 258 miles; and to Rochester, N.Y., 372 miles.

FIG. 1. ALLEGHENY RIVER in extreme northeasterly section of Mississippi watershed joins with Genesee River to form waterway connecting Gulf Intra-Coastal Canals with New York State Canal System and Great Lakes.

Tributary Area

The Allegheny-Genesee Waterway will connect two waterway systems already improved and carrying great traffic volume. The immediate tributary area includes western Pennsylvania and western New York. The areas to receive benefits from traffic through the waterway will include New York, New England and eastern Canada in the north, and the Ohio River and Mississippi River Valleys in the south.

The areas of immediate benefit contain 30 per cent of the combined populations of the United States and Canada and have 40 percent of the combined industrial production of the two countries. United States exports to Canada have always exceeded the imports and in a large measure the exports are the materials available via the Ohio River and the Allegheny-Genesee Waterway.

A general knowledge of the regions to be connected shows that climate, soils, forests, minerals, water resources, topography and water transportation have been the predominating factors in giving direction to the development of the greatest industrial empire in the modern world.

The settlement and growth of cities on tidewater was followed by the growth of cities on the larger inland waterways. As industry expanded along the waterways, new services, new commerce, new transportation, and a greater population developed in the inland areas adjacent to the waterways.

Region North of the Waterway

The region comprising New York, New England and eastern Canada has 20 per cent of the combined manufacturing production of the United States and Canada. The New York State Canal System joins Lake Erie and Lake Ontario on the west with the St. Lawrence River and the port of New York on the east.

New York. New York is the greatest industrial state in the United States. Ninety percent of its total production is reported from industrial areas and places of more than 10,000 population, having terminals and ports on the New York State Canal System. A Pittsburgh steel company has a source of iron ore at Star Lake, N.Y., and will ship 800,000 tons annually. A steady flow of the finished products manufactured in New York are marketed in the Ohio and Mississippi River Valleys and in the Southwestern States.

New England. The New England States as a group, compared with other single states, rank third in industrial production in the United States. Industries which depend upon metals for their raw materials comprise the most important group of all New England manufacturers. They cater to a nation-wide market. The principal items consumed are iron and steel, in stages of partial manufacture ranging from pig iron and blank castings to bar and sheet iron and steel and forgings, also brass, bronze, copper, tin, and other nonferrous metals.

About 42 percent of New England's total rail tonnage, both inbound and outbound, is carried by the railroads that cross the middle western boundary of New England. One of the principal gateways into southern New England is through New York City where connections are made with various trunk lines.

POTENTIAL TRAFFIC for proposed Allegheny-Genesee Waterway, consisting primarily of coal, petroleum and its products, and iron and steel and their products, already exists on upper Ohio River. Steamer "Monongahela" (above) has million-dollar steel tow—20 barges of steel products and two fuel flats. Steamer "Reliance" (below) has typical gasoline tow on Allegheny at Pittsburgh, Pa., where barge traffic exceeds ship traffic of Panama Canal.

About 80 percent of all New England's water traffic is coastwise shipping. The greatest volume of movement is between New England and Atlantic and Gulf of Mexico ports.

Eastern Canada. The provinces of Quebec and Ontario have 50 percent of the population and more than 80 percent of the industry of Canada. A study of a few selected industries depending on bulk materials for their manufacturing processes, indicates that over 15,000,000 tons of raw and intermediate materials that can be made available via the Allegheny-Genesee Waterway, are imported annually.

Region South of the Waterway

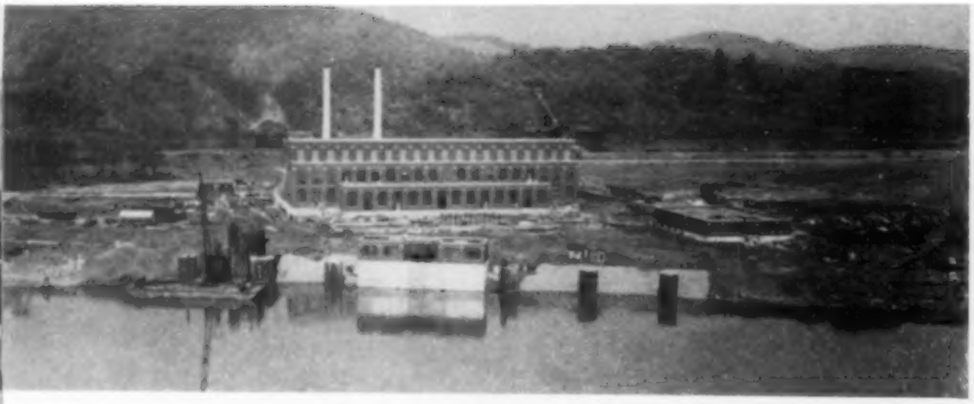
The region contiguous to the junction of the Allegheny, the Monongahela, and the Ohio Rivers is the greatest mineral producing region in the United States. The value of the mineral production is 45 percent of the value of all minerals produced in the United States. These minerals are adapted to water haul as are the intermediate and finished products made from them.

The larger mines that extract, and the factories that process the minerals of the Ohio Valley, as well as imported raw materials, are generally located on the river banks and have rail-river terminals.

Pennsylvania is the second industrial state in the Union. Pittsburgh is the heaviest tonnage-producing district in the world. Iron and steel and their products comprise the predominant manufacturing industry in the Ohio River Valley.

Waterways extend from Pittsburgh to the Gulf of Mexico, and the canalized tributaries of the Mississippi River penetrate the Middle Western states and the western slopes of the Appalachian Mountains. The heaviest canal barge traffic in the United States is at Pittsburgh—exceeding the ship traffic of the Panama Canal.

Natural Resources. The Allegheny River flows through the "greatest storehouse in the United States, the Appalachian coal region," where there is available potential tonnage of limestone, sandstone, clay, forest products, and petroleum products. On its southerly course the river enters successively all the productive strata of the Pottsville formation; and thence through all the productive strata of both the Pottsville and



SITES ALONG PROPOSED WATERWAY, between source of material and market, offer economical locations for industry. Linde Air Products Co. plant pictured here is located on right bank of Allegheny River 44 miles above Pittsburgh.

ALLEGHENY FLOWS THROUGH GREAT APPALACHIAN COAL REGION as well as areas offering potential tonnage of limestone, sandstone, clay, forest products and petroleum products. Consumers Mining Co. installation at Deer Creek on Allegheny River loads coal barges for economical shipment to distant points on inland waterways.

Allegheny formations, to East Brady, Pa. South of East Brady the productive strata successively descend below the water level, with the consequent increased and, finally, prohibitive cost of mining.

On the Allegheny River between Oil City and East Brady is a stretch of 63 river miles where the recoverable and marketable reserve of mineral resources accessible for potential water-borne bulk tonnage to the nation's industries probably far exceeds the reserve tonnage of all the valuable natural resources on any equal stretch of the Mississippi or its tributaries.

Computations were made of that portion of the valuable and economically recoverable natural resource reserves yielding to a reasonably reliable estimate. These computations (Table I) show the potential tonnage is more than adequate to sustain the heavy annual movement required to justify the annual charges for improving the Allegheny River section of the waterway.

Prospective Water-Borne Traffic

In this review of the existing potential traffic for the Allegheny-Genesee Waterway, the available data concerning three commodities, known to be extensively transported on the Upper Ohio River, bituminous coal, petroleum and its products, and iron and steel and their products, are examined.

Bituminous Coal

Annually 346,000,000 tons, or 60 percent of the total consumption in the United States, is produced in the Ohio River Valley in the three states of Pennsylvania, West Virginia and Ohio. There is loaded for shipment on the Ohio River waterways 32,500,000 tons, of which 29,000,000 tons are loaded for shipment on the improved Allegheny and Monongahela Rivers.

New York State receipts of coal from the Appalachian fields are 29,000,000 tons: by rail 16,000,000 tons, by Lake cargo 3,000,000 tons, and by tidewater 10,000,000 tons. New England receipts are 19,000,000 tons: 10,000,000 tons by rail across the Hudson River, and 9,000,000 tons by tidewater. Quebec and Ontario receipts are 9,500,000 tons, practically all by rail and lake cargo; the tidewater receipts are negligible.

By inland routes, rail and lake cargo, there is an annual movement of 38,500,000 tons from the region of the Ohio River Waterways to destinations north of the Allegheny-Genesee Waterway. These destinations include those on the 800 miles of the New York State Canal System as well as those on the Great Lakes and the Canadian navigable rivers.

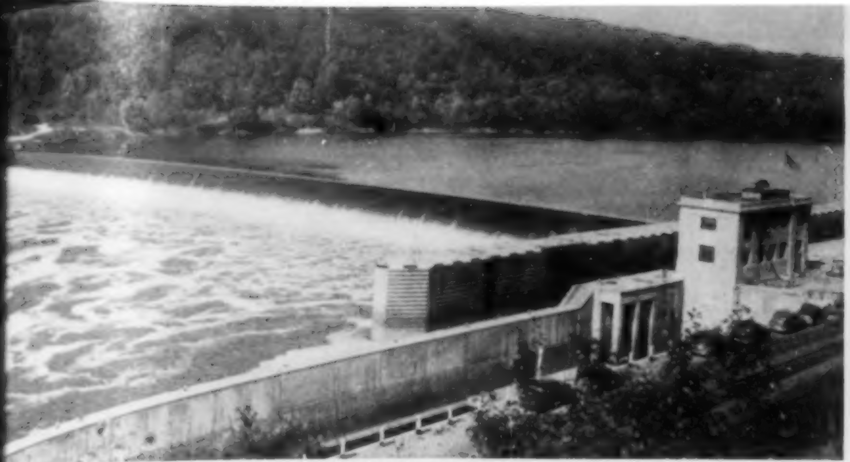
By tidewater there is an annual movement of 19,000,000 tons from the Appalachian fields to New York and New England. This coal is shipped by rail from inland mines to Hampton Roads, transferred to coastwise vessels for tidewater shipments to New York and New England ports, and there again transferred to barges, motor trucks, and railroad cars for inland destinations.

New York and New England lack mineral fuels and are at a disadvantage in cost of steam power as compared with coal producing states. The high degree of industrialization in New York and New England make the matter of an adequate and economical power supply one of the vital

TABLE I. RESERVES—SELECTED VALUABLE NATURAL RESOURCES ON THE ALLEGHENY RIVER NORTH OF ALLEGHENY COUNTY, PA.

Resources	Quantity, Short Tons	Use
Bituminous Coal	5,594,800,000*	Steam—by-product—domestic
Vanport Limestone	11,559,000,000†	Flux—concrete aggregate—road metal railroad ballast—cement—lime
Pottsville Sandstone	8,170,000,000*	Molding sand—glass sand—refractory stone—paving sand—concrete aggregate—railroad ballast—grinding sand
Refractory Clay	13,173,500,000*	Fire clay—fire brick—building brick and tile—pottery—sewer pipe—terra cotta
Petroleum	135,580,000‡	Gasoline—fuel oil—wax—lubricants
Forest Products	584,684,000*§	Logs—lumber—mine props—railroad cross ties—crates—pulp wood—furniture—chemical wood
Total Estimated Reserves	39,217,564,000	

* For entire counties of which all or a substantial part lie within 20 miles of the Allegheny River.
† Limited to occurrence within 20 miles of the Allegheny River.
‡ Refineries being located on the river banks, the total reserve for contiguous counties is used.
§ Forest yield for 100-year period.



CONTINUALLY INCREASING WATER-BORNE TONNAGE in Pittsburgh district will be further augmented when natural resources of Allegheny Valley are tapped by proposed navigation improvements. View shows Lock and Dam No. 9 on Allegheny above Pittsburgh.

factors in the continued development of that region.

Low-cost power is dependent on low-cost fuel, which in turn is dependent on low-cost water transportation. On all barge hauls from the coal mines on the Upper Ohio River to practically all the major industrial areas in New York and to the Hudson River for transshipment by rail or motor truck into New England, the Allegheny-Genesee Waterway will afford low-cost haul with the least degradation of coal, to the steam power plants of New York and New England.

The total annual movement of bituminous coal northward from the Ohio River region is 57,500,000 tons. Excepting only the coal transferred to motor trucks for consumption near ports of entry, this figure represents potential tonnage for the Allegheny-Genesee Waterway.

Petroleum and Its Products

New York receipts are 8,600,000 tons: by rail and lake cargo 2,400,000 tons, and by tidewater 6,200,000 tons.

New England receipts are 13,000,000 tons: by rail across the Hudson River 8,000,000 tons, and by tidewater 5,000,000 tons.

Quebec and Ontario receipts are 4,000,000 tons.

The region north of the waterway, by inland routes, rail, and lake cargo, received 14,400,000 tons annually by a northward movement from the southern oil fields. By tidewater, there is an annual northward movement of 11,200,000 tons shipped from Gulf ports. The greater part of the total northward annual movement of 25,600,000 tons represents potential tonnage for the Allegheny-Genesee Waterway.

Iron and Steel and Their Products

Annual rail shipments to New York State are about 1,000,000 tons. Industries that require iron and steel in various forms dominate the manufacturing of New England and, with the exception of pig iron, great quantities are shipped in from other states.

In 1944, the United States exported to Quebec and Ontario iron and steel products with an approximate value of $300,000,000. In normal years the value of the exports will approximate $200,000,000.

Incidental Benefits

A Facility for National Defense

The coastwise receipts of 34,000,000 tons in 1941 at the port of New York were decreased to 6,700,000 tons in 1943. Rail traffic was congested and shipments delayed. In the meantime many human lives and valuable vessels were destroyed.

The United States has been at war during 10 percent of its years of national existence. Should this country and Canada be surrounded by hostile powers, then the economic justification of the waterway would be secondary, and the military value of relieving railroads and diverting coastwise traffic to the connecting inland waterways would predominate.

Industrial Development

The tributary area has the greatest consuming and buying power in the world. With the country's present increase in population, new investments for new facilities will be required in industry, commerce, and transportation. The most economical location for industry is at the source of materials, at the market, or along the connecting transportation routes between the source of materials and the market.

The region south of the waterway produces raw and intermediate materials. The region north of the waterway manufactures finished products. The waterway will furnish low-cost transportation for commerce between the two regions.

As a result of the recent decision of the U.S. Supreme Court changing the freight-rate base point system for cement to an f.o.b. mill system, the U.S. Steel Corp. and others have adopted the f.o.b. mill system for steel pricing. Other producers of raw and intermediate materials are working out new pricing schedules. Within a few weeks after the new increased steel prices of $2.00 to $15.00 a ton were announced, the Kelsey-Hays Wheel Co. of Detroit took over a 25-acre tract in the Pittsburgh district, with 28 buildings, to employ 1,500 persons. Both the Wheel Company and its supplier of steel have terminals on navigable rivers. This f.o.b. mill system of pricing has the effect of penalizing the fabricator farthest removed from his source of materials. Penalizing the distant fabricator will have the effect of causing fabricating plants to cluster around the supplier, usually in an already congested center. This is the opposite of the great postwar cry that industry must be decentralized.

Because the Allegheny-Genesee Waterway is located in a lightly populated district surrounded by congested areas, it will open the tributary valleys to industrial development and the consequent supporting population.

Conclusions

The Allegheny River offers an available, route, utilizing natural channels in the entire distance traversed, for a waterway freight line between the Ohio River at Pittsburgh and New York State.

An estimated 39,000,000,000 tons of recoverable valuable resources in the Allegheny Valley and the commodities they can originate, should be made accessible to the regions north and south of the waterway.

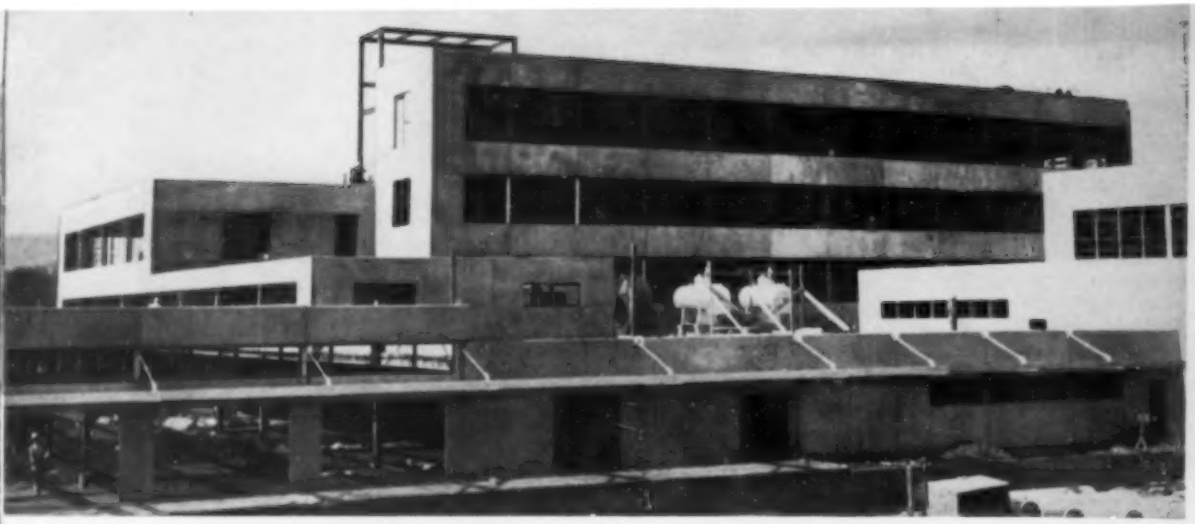
The connected waterways are so located that a large portion of the interregional freight traffic of the tributary area would be available for movement on the Allegheny-Genesee Waterway.

The regions north of the waterway are now relying on expensively transported fuel and lubricants of which 83,000,000 tons move generally parallel with or by circuitous rail-ocean-rail routes around the Allegheny-Genesee Waterway and the connected waterways.

Potential traffic already exists to justify the waterway.

The waterway will constitute a facility for the national defense.

Low-cost water transportation will increase the distribution of products in markets on the inland waterways and will develop new tonnage that is now not moving because of high freight rates.



MASSIVE APPEARANCE OF PRECAST CONCRETE PANEL WALLS of Chattanooga nylon plant is that of cyclopean masonry with texture and color of tooled limestone. Research in building design by du Pont Company led to panel-type construction.

Insulated Precast Concrete Wall Panels Prove Economical Substitute for Brick

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ANOTHER STEP in the development of rapid production-line methods in the construction field is marked by the successful use of insulated precast wall panels in building the new du Pont nylon plant at Chattanooga, Tenn. The panel system of construction proved faster than conventional masonry, saving an estimated two months' time in enclosing the building. Investigation of panel construction was undertaken by the du Pont Company to develop new methods which would lower costs, speed construction and serve as an alternate type of construction in an emergency. An acute shortage of bricklayers in the Chattanooga area caused such an emergency. Steel for the nylon plant described herein was originally designed for brick walls. The switch to panel construction was made without other major changes in design.

MOST PROCESS INDUSTRIES, such as the du Pont Company, require a tremendous investment in buildings. Because of technological advances, competition, new products developed by research, and increasing public demand for greater production, these industries are forced to engage in more or less continual construction. This necessity, coupled with rising building costs and shortages, plus the promise of new developments, prompted the du Pont Company to undertake research in building design. Materials, methods, trades, supplies, and location complications of the industry gave the researchers a wide field to look into.

A small group was organized early in 1946 to coordinate the work of other groups and individuals within the company who, generally paralleling their regular work, are investigating the materials and methods selected for study. In addition to collecting, correlating, and evaluating existing information, developmental work is carried on by du Pont and encouraged in other industries by suggesting fields of effort and desirable characteristics of new products for building construction.

The first assignment was the study of walls, the most complicated element of construction undertaken. The job was to find or develop satisfactory walls which would give maximum coverage in minimum time with the most efficient use of field labor.

With that goal set, procedure followed three general lines: (1) Precast masonry panels; (2) prefabricated metal plank; and (3) new materials for otherwise conventional construction. The first two categories fit into the large-scale mass-production type of construction. Prefabrication or precasting of units for later assembly is, of course, the essence of production-line technique. This paper deals with the investigation of precast masonry panels.

Investigation of materials, methods, and commercially cast units, together with practical trials, led to the following preliminary conclusions concerning panels:

1. Materials should be the simplest and most readily available locally, commensurate with their efficiency in meeting necessary requirements of the wall.

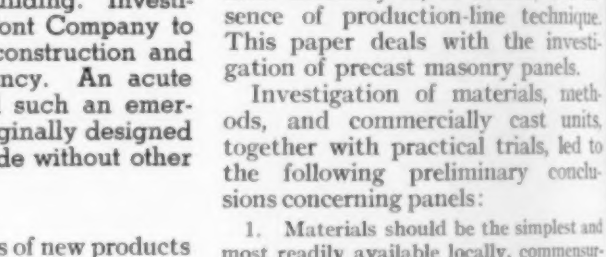


FIG. 1. CUT-AWAY VIEW shows details of construction of insulated precast panels and method of anchoring to building frame originally designed for brick enclosure. Shelf angles welded to columns support ends of panels.

JOB-BUILT MULTIPLE STEEL WHEEL vibrator compacts first layer of concrete and embeds reinforcing mesh prior to removal of excess water by vacuum process.

SATURATED GYPSUM FILLER BLOCKS are laid and inserts for lifting and holding bolts are placed on first layer of vacuumed concrete which comprises inner face of panel.

2. Parts, pieces, and operations should be simplified with the same consideration in mind.

3. Current scarcity of form lumber requires maximum re-use of forms.

4. Casting in a vertical position often causes unacceptable surface imperfections, such as form marks, glaze, and bubbles.

5. Casting in a horizontal position permits almost any desired treatment of the exposed face.

6. The surface to be finished should have a rigid backing to withstand finishing pressures.

7. Doweling between panels causes erection difficulties. Therefore, a self-aligning joint is preferable.

On the basis of the foregoing conclusions concrete panels were developed which fulfilled the requirements of a good wall, and were feasible for use under existing conditions in the Chattanooga area.

Despite the lengthy studies made, when the time came for construction, several practical problems remained to be solved, and many short cuts were tried. For instance, there was no certainty as to how accurate the casting would be. Also, it was necessary to try different surfaces for casting, and there were many other things which had to be worked out as the job progressed. One moderately successful short cut for compacting the first layer of concrete and embedding the reinforcing mesh was the use of a vibrator mounted on ten wheelbarrow wheels (see accompanying photo). The method could possibly have been improved by using disks or narrow-rim wheels.

After all factors were considered, a 24-hour casting cycle seemed both feasible and desirable. The procedure adopted comprised using a modified standard Portland cement, vacuum processing the concrete, and lifting the green panels off the casting floor into a vertical position by vacuum pads. The number of sizes, shapes, and special edges was reduced to a minimum to simplify production. These factors set the pattern for actual design.

The panels are essentially big flat sandwiches of light insulating blocks surrounded by Portland cement concrete (Fig. 1). They were poured with the interior face down. The casting floor was a concrete ground slab with transverse wood nailing strips flush with the surface. Edge forms of wood were nailed to the strips. Close tolerance required rigid forms, accurately placed. None of the casting methods tried turned out an interior facing that was entirely satisfactory.

Originally, plans called for stretching canvas on the deck to facilitate breaking the panel loose and to provide a pleasing surface texture. However, the canvas stuck to the green concrete and was permanently distorted when pulled off. Several kinds of building paper were tried also. An asphalt-impregnated kraft paper was finally used, but wrinkling, sticking, and panel cleaning difficulties impaired the appearance and made its use far from ideal. A renewable marine-plywood casting floor may prove to be a practical solution and improve the appearance of the panel surface.

Casting of Panels

Concrete was placed in two stages. The first stage was up to the level of the gypsum blocks. Steel mesh was laid on and embedded with the makeshift vibrator described above. Previously saturated blocks were placed and the second layer was poured up to the top of the forms. Each stage was vacuum processed. Considerable consolidation took place during the vacuuming, and the lost volume was replaced by approximately $^1/_4$ in. of grout at the top of the forms.

The grout was hard steel troweled and the edges round tooled. The final textured finish was applied by drawing a hair push broom laterally across the face of the panels to produce straight, fine, closely spaced lines which broke up the uneven glaze-like finish left by trowels.

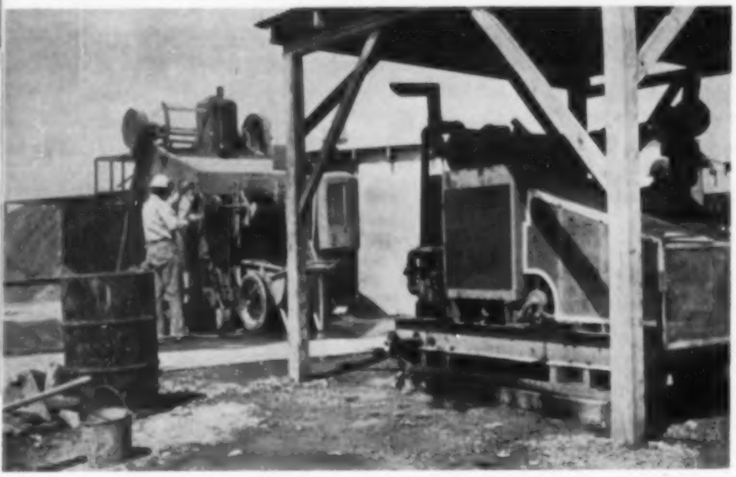
Forms were removed and panels lifted the morning after pouring, and the procedure was repeated to maintain the 24-hour cycle. Panels were lifted to an upright position by vacuum mats and crane, but from then on the load was carried by eyebolts in the top edge inserts. Although the units were immediately carried to the curing racks, there was no sign of strain. Water curing with blankets for seven days was specified.

Test panels broken after drying several weeks showed satisfactory interior conditions. Filler blocks were firm but somewhat damp. There was no evidence of internal fractures or external shrinkage cracks. Absence of cracks may have been partly due to moisture retained in the blocks. Inspection showed that the concrete did not flow into the core holes in the blocks.

After curing and aging, the panels were carried to the erection site on a special buggy to be put in place. Unavoidable variation in the relative location of holding bolt inserts and structural steel made it necessary to spot each of the column lugs and shelf angles individually and weld them as panels were placed.

Refinements in casting produced unexpected dimensional accuracy but too late to offer any advantage on this particular job. Few panels varied from specified tolerance and none varied by more than $^1/_4$ in. This variation was neither troublesome nor noticeable, nor was the effect of a $^1/_2$-in. misalignment of structural steel. It was necessary for the sake of appearance to keep adjoining faces within $^1/_4$ in. of being flush with each other.

Panels were used for exterior walls only, because they are too heavy and bulky to place easily in interior locations. The possibility of alterations after the building was complete made the precast units impractical for use as partitions. Average panel size is 80 sq ft, but they run as large



OUTER FACE IS VACUUM processed (above) and approximately $^1/_4$ in. of grout is added to replace lost volume. Several sizes of mats are available for simultaneous processing of entire panel of any size and almost any shape. Completed panels are cured and stored in racks in background. View at left shows vacuum pump (right foreground) and concrete mixer (center).

as 200 sq ft. They are 7 in. thick, and have an average weight of 65 lb per sq ft. The only limitations on size for construction of this type of panel are the practical ones incident to erection. Under ideal conditions, one crew placed 2,700 sq ft of panels in a day. See detailed characteristics in Table I.

Panels Are Fire Resistant

The exact construction used in these particular panels has not been fire-tested, but du Pont's Safety and Fire Protection Division gives it a tentative three-hour rating. This decision is based on the National Board of Fire Underwriters' rating of 4-in. hollow gypsum block well plastered on both sides. Thermal conductivity tests were not run, but the calculated average heat transfer coefficient is about half that of a damp 8-in. brick wall. Insulation is considered sufficient to prevent condensation under summer and winter comfort air conditioning in the Chattanooga climate, except in the most extreme winter weather. Fire-hose tests and experience with other panels indicated satisfactory tightness.

The weight of the precast units is about equal to a brick wall of the same thickness, but because the panels are only 7 in. thick, they are considerably lighter than an 8-in. brick wall furred or insulated for similar air conditioning.

In an effort to simplify the panel design to the greatest extent, some features were omitted or were replaced by more practical ones. For instance, lighter weight could have been obtained by using aerocrete blocks and special aggregate, but the added cost could not be justified. White cement surface would have been more attractive, but would have meant another material with added cost and non-homogeneity in the weathering face, so it was not used.

Concrete mix specification was standard in practically all respects. Principal objectives were absence of shrinkage cracks, close control, and uniformity. Limits were set on potential chemical constituents of the cement which control the heat of hydration and reduce shrinkage. No admixture was used. Locally available aggregate gave satisfactory results, although it was not the high-quality, sound aggregate which was considered essential for the densest surface.

On the nylon plant construction described here, the fillers are commercial cored gypsum blocks commonly used for partitions. Any lightweight insulating filler blocks would serve the dual purpose of reducing weight and thermal conductivity—their only functions. Convenience, cost, and availability dictated their use. Webs of concrete between blocks bind faces and furnish rigidity and shear resistance. Tests showed good bond between webs and the vacuum-processed face at the bottom of the blocks.

Reinforcing steel was reduced to a perimeter bar on the inner face for carrying wind and dead load. Panels are supported at the ends on shelf angles. Additional beam steel would have been required in the top edge, if the vacuum pad method had not been used for lifting green panels from a horizontal to a vertical position on the casting floor. Inserts for lifting bolts, used after panels were vertical, were anchored with hooked bars, while identical inserts for holding bolts were anchored with short pins. Temperature mesh in both faces was galvanized in order to retard rusting.

Four edge shapes were used: tongue, groove, square, and rabbet for sash jambs. A separate coping was poured in place, but it could have been integral or precast. Tongue-and-groove joints proved better than ship-lap because they are self-aligning and more uniformly weather-tight. They were sealed with a proprietary plastic bituminous gasket and later calked with asbestos rope and standard calking compound.

TABLE I. CHARACTERISTICS OF PRECAST CONCRETE PANELS—CHATTANOOGA PLANT

Maximum area	200 sq ft
Average area	80 sq ft
Maximum length	27 ft 8 in.
Maximum width	10 ft 1 in.
Thickness	7 in.
Tolerance, dimensional out of square or plane	$^1/_8$ in.
Weight, average	65 lb pfs
Width of joint opening	$^3/_8$ in.
Heat transfer coefficient, computed average	0.24 Btu/(hr)(sq ft)(deg F)
Concrete compressive strength (28-day specified)	3,500 lb psi
Concrete compressive strength (20-hr actual average)	1,100 lb psi
Concrete slump	8 in.
Cement	ASTM C-150

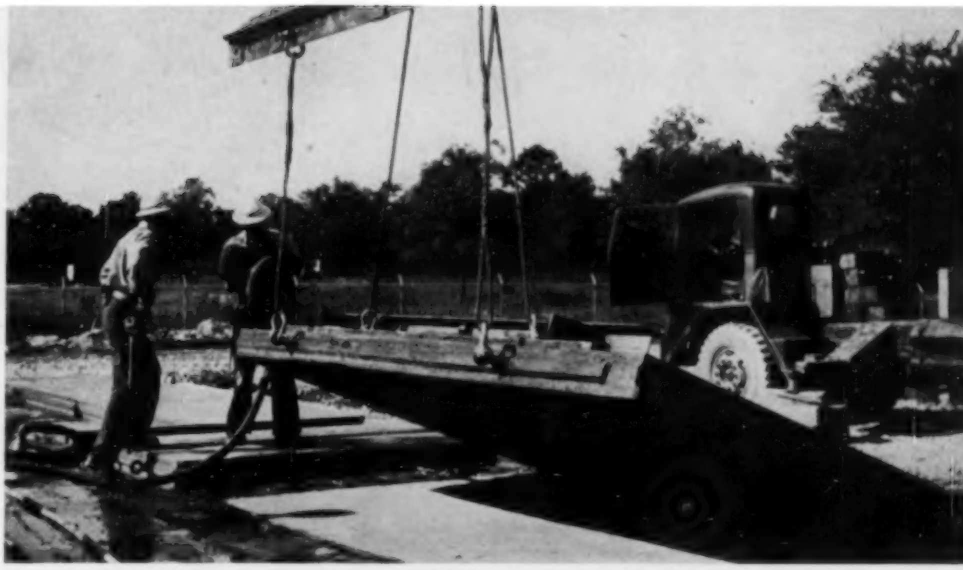
With the following chemical composition:

Chemical Comp.	Cement Industry's Accepted Abbr.	Percent
$4CaO \cdot Al_2O_3 \cdot Fe_2O_3$	C_4AF	11.6
$3CaO \cdot Al_2O_3$	C_3A	7.1
$CaSO_4$	$CaSO_4$	2.9
$3CaO \cdot SiO_2$	C_3S	44.6
$2CaO \cdot SiO_2$	C_2S	28.7
$Na_2O + 0.658K_2O$	Soda equivalent	0.5
Fe_2O_3, SiO_2, MgO and others		4.6

Separate window sills and lintels were eliminated, the standard tongue edge being carried across window openings at the bottom and the groove edge at the top. Omission of the projection of conventional sills enhanced the massive architectural effect. Steel sash of a standard projected type are held in place by separate angles. Door frames are structural channels with flanges projecting to form slots which engage abutting panels. Roof flashing is held in reglets.

Panels, cast with inserts, were bolted to lugs welded to the structural steel columns. Long-threaded bolts with threaded washers held the panels at the desired distance from the steel. Locational tolerance in structural columns was specified at ½ in., but this arrangement of bolt and threaded washer provided for adjustment in case of greater error.

Integral interior finish is achieved if certain conditions of appearance are acceptable. Joints between panels may be covered by columns and floors, but on the Chattanooga job, in walls without continuous sash, the combination of panel size and ceiling height often brought a horizontal joint somewhere in the wall of a room. Columns in principal offices were covered with metal shields.



PANEL IS RAISED FROM CASTING FLOOR by means of crane and vacuum lifting mat. When panel reaches upright position load is transferred to eyebolts in top edge. Pouring-lifting cycle takes 24 hours.

Improvements Being Studied

Although the wall as built is satisfactory, several improvements are being studied. For instance, the method of fastening the panels to structural steel presented many difficulties on the Chattanooga project. The difficulty of accurately holding inserts on the bottom or inner face during pouring resulted in inaccuracies which required costly individual spotting and welding of column lugs. Also, exposed bolts and lugs did not look well on the interior of the building. Split shelf angles, which would serve both for support and holding, may be the solution to that problem.

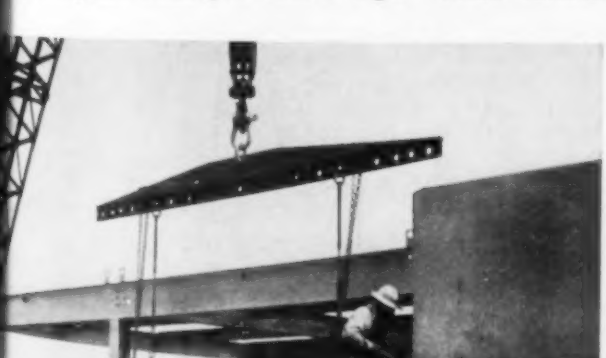
The accuracy of work obtained indicates that the angles could be located and furnished by the structural fabricating shop. The outstanding leg could be punched for a single vertical holding bolt at each end of the top edge of each panel. Inserts for the bolts could be accurately located by holding them on the edge forms. Shelf angles could be unbolted and removed while each individual panel is being placed, then bolted on again when the panel is in position. Erection would be simplified by this method, and the appearance of the inner face of the wall would be improved.

Experience showed that edge shapes at window openings and the method of holding sash should be improved. A plywood casting deck would facilitate holding reglet inserts. Also, it may be possible to simplify joints.

Concrete panel construction is not new, but it has not been widely used by builders and has not been developed adequately. The du Pont Company investigation was the outgrowth of a serious need for production-line methods of construction to speed erection and to reduce costs. Responsibility for the research rested with a small group in the engineering department, but the investigation and development were carried out by many men working together on the design and construction. The panel used at Chattanooga was developed from a suggestion by K. P. Bilner, president of Vacuum Concrete Company. The design is not patented.

The cost of panel construction for the Chattanooga plant proved to be comparable to brick. The structural steel for the plant was designed for brick enclosure. Had it been designed for panels to permit greater uniformity in panel size and detail, there would have been some appreciable savings. Further improvements in the making and placing of panels may lead to substantial cost reduction in large-scale building. Low cost in erection depends largely upon two things: A clear path for the erection crew, both on the ground and in the air; and accuracy of panels and structural steel.

Under the existing circumstances, the saving in construction time of the building was substantial. The investigation conducted, plus the experience gained in making and placing the panels on the site, proved that the panel system has advantages under certain conditions. It should produce appreciable savings where buildings are designed specifically to take advantage of uniformity of panel size and where bricklayers are scarce. The system still needs to be perfected, but experience at Chattanooga answered many of the problems which arose.



CRANE MOVES PANEL into position for bolting. Shelf angles are omitted for top course of narrow panels. Support is furnished by standard holding lugs visible here. Under ideal conditions crew placed 2,700 sq ft of panels per day.

Steel Arch Construction Expedites Repair of Explosion-Damaged Sewer

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FOLLOWING AN EXPLOSION in a 2,825-ft length of 84- to 92-in.-dia sewer outfall, the Terre Haute, Ind., Board of Public Works and Safety entered into an emergency contract with the Thompson Construction Co. of Indianapolis to remove the blocked section and restore normal flow. Emergency work was successful in preventing sewage from backing into adjacent basements, which would have increased the damages considerably. The Board of Public Works and Safety retained the firm of Hutchins and Nehf, consulting engineers of Terre Haute, to plan and supervise the reconstruction of the sewer. Details of repair methods considered and those employed in rebuilding the damaged section under adverse conditions, while maintaining flow in the sewer, are described herein.

SEVERE DAMAGE to the Hulman Street sewer, one of Terre Haute's main outfalls, occurred as the result of an explosion caused by the accidental escape into the sewer of about 2,000 gal of benzol from the storage facilities of a concern located at the corner of Hulman and 13th Streets. Between 9th and 10th Streets the entire top of the three-ring brick sewer was shattered. The debris, including 12 ft of overburden, dropped into the void left by the explosion, completely blocking the flow which is composed of both sanitary and storm-water runoff. Fortunately the weather was cold and no surface drainage entered the sewer, but ten days after the explosion, in spite of the lack of surface runoff, the influx of sanitary sewage alone practically filled the sewer on the upstream side of the blocked section.

Existing utilities affected the manner in which the repair work could be done. A 12-in. steel gas main under the gutter on the south side of the street feeds the principal storage tanks from which gas is delivered to the cities of Terre Haute, Clinton, and Brazil. Had this line been broken, these cities would have been without gas until repairs could have been made. A 10-in. cast-iron gas main 3 ft below the street surface, serving local users, was broken by the explosion and had to be relocated for the length of the excavation but gave no trouble. Under the gutter on the north side of the street is a 12-in. cast-iron water main which supplied all the south end of Terre Haute.

Since the soil through which the sewer passes is composed almost entirely of saturated sand and fine gravel, the only feasible means of removing the block and repairing the damaged structure was to drive sheetpiling the entire length and on both sides of the excavation. Steel sheetpiling, promptly ordered, was delivered to the job in three days.

A 700-lb air hammer was hung from the end of a crane boom and used for driving the piling. Later, the same crane served in pulling the piling.

Shortly after the explosion, the interior of the sewer west of the block was inspected by representatives of the city, the Indiana Gas and Chemical Corp., and Hutchins and Nehf, engineering consultants. East of the block it was impossible to get into the sewer at that time because of the backed-up sewage. Twelve days after the explosion, however, enough of the block had been removed so that an inspection east of 10th Street could be made.

The original sewer was composed of three rings of brickwork with a circular section of varying diameter. East of 11th Street the diameter is 84 in.; between 11th and 8th Streets, 88 in.; and west of 8th Street, 92 in. During the original construction no header bricks were placed to bind the three rings into a unit.

Inspection showed that throughout the damaged section the top half had suffered from the explosion, but that the invert was still in good condition. Part of the sewer could be repaired from the inside by applying a seal,

STEEL SHEETPILING holds unstable sand and gravel through which damaged section of Terre Haute sewer passes, thus protecting gas and water mains in vicinity. Piling is pulled and redriven as excavation and backfilling operations progress over 2,825-ft length of job.

ut the remainder was in such an un-table condition that the pavement nd overburden would have to be re-moved and the top half of the sewer ompletely replaced with new ma-erial.

Three Repair Methods Considered

Where the top section of the sewer ad to be replaced, there were three hoices as to the material to be used: 1) Three-ring brick; (2) reinforced oncrete; and (3) corrugated steel rch. On the basis of cost of material nd estimated time of construction, n Armco Multi-Plate arch, bitu-minous coated, with a 96-in. span nd a rise of $45^1/_2$ in., was selected. Estimates of cost varied from \$45.00 per ft for the three-ring brick design, and \$40.00 per ft for reinforced con-crete, to \$18.70 per ft for the corru-gated steel arch. These estimates did not include the cost of removing the existing concrete pavement, driving and pulling sheetpiling, excavating, and backfilling, since such operations were common to all three types of reconstruction.

The Multi-Plate arch was delivered without the usual steel angle attached at the springing line, since the engi-neers believed that the best method of attaching the arch to the existing brickwork was as follows:

1. To strip the old brick to the elevation of the center line of the sewer.
2. To cast a reinforced concrete receiving trough on the old brick-work.

SHATTERED CROWN OF THREE-RING BRICK SEWER is removed in preparing old invert, which is still in good condition, for arch installation. Corrugated steel sections will rest in troughs of reinforced concrete caps on each side of old section. Old brick section appears in background.

3. To set the steel arch in this trough.
4. To fill the trough with asphalt seal.

Through the use of high early strength cement, no time was lost waiting for the concrete to gain strength. Normally the concrete trough was cast on one day and the steel arch was set the next day. Experience with the corrugated arch proved it to be very easy to handle. As the men on the job became accustomed to the work of assembling the three pieces into which each arch was divided, greater speed was attained. Previous experience had demonstrated to the writers that the speed attained through the use of the steel arch far exceeded that which could be attained with either three-ring brick or reinforced concrete construction, the alternate methods considered.

Junctions between the steel arch and the existing brick top at each end of the steel-arch section were made by cutting the brick roughly to a straight line and then filling openings with concrete reinforced with welded wire mesh. The repair material chosen for that part of the sewer which could be sealed from the inside was a 2-in. thickness of Gunite reinforced with welded wire mesh which consists of 3-in. squares of No. 10 wire.

CORRUGATED STEEL ARCH is placed on reinforced concrete receiving trough. Crew spends alternate half days in casting concrete troughs and assembling arches. Use of quick-hardening concrete accelerated these operations.

High Temperatures Create Problem

Although the explosion occurred in cold weather, the asphalt-coated arch was placed at a time when temperatures in the high nineties made working conditions extremely difficult. Augmenting the high air temperatures was the heat from large quantities of cooling water from the ammonia stills of the Terre Haute Gas and Chemical Co., which is discharged at about 170 deg F. However, a device consisting of a spray nozzle taking water from the city water supply and discharging it on the inside of the arch, helped materially in keeping temperatures within workable limits, and little absenteeism resulted.

When 20 to 30 ft of arch had been placed, material from the excavated section ahead was brought back and carefully placed as backfill. Extreme care was taken to raise the fill on

TRANSITION SECTION connecting ends of steel arch with brick of undamaged sewer is 2-in.-thick application of Gunite reinforced with welded wire mesh. View at Center Street end of project (above) shows point at which Gunite meets old brick construction. View of other end of project (right) shows steel arch (foreground) and Gunite-treated crown (background).

both sides of the new structure at the same rate to avoid any distortion of the arch. When the backfill had been raised to within 3 ft of the street level, the sheeting was pulled and all backfilling completed. The constant movement of trucks and bulldozer employed in this operation assisted greatly in compacting the fill. No paving was placed for a considerable period of time to insure complete settlement of the subgrade. During the entire reconstruction period, flow was maintained in the sewer.

The total length of sewer which required replacement of the crown was 2,825 ft. Gunite repairs covered an area of 12,212 sq ft at a cost of $14,507.48. The entire job, including repaving the street, cost $240,000.

The Board of Public Works and Safety for the City of Terre Haute is composed of Paul G. Lindeman, city engineer and president of the board, John F. Fitzgerald, city attorney, and C. C. Connelly, city controller. V. R. McMillan is mayor. Mr. Lindeman worked closely with the consulting engineers, Hutchins and Nehf, to the betterment of the project.

Static Load, Not Impact, Determines CAA Design Standard for Airports

IMPACT OF AIRCRAFT at the moment of landing, long considered the critical load to be borne by airport pavements, has been officially discarded as a factor to be considered in the design of runways, according to the Civil Aeronautics Administration's new design manual. Quoting from the manual, Walter R. Macatee in his *Out at the Airport* series explains that the static or standing load of an airplane is its greatest load. Because aircraft are partially airborne when taxiing, and largely airborne when landing, the dynamic (moving) and impact loads are less critical than the static loads. "Therefore pavements designed for static loads will be adequate for all loadings," the manual states.

That taxiways need to be substantially thicker than the main portions of runways is another point emphasized by the CAA manual, which requires that concrete runways shall be thickened by 2 in. in areas bisected by taxiways. A far greater number of loadings—called increased repetitional loadings by airport paving designers—is the reason why taxiway pavements need to be thicker than those of the same type used on the principal portions of runways.

Service records clearly show, CAA engineers state in the new manual, that taxiways, aprons, turn-arounds, and warm-up pads at the ends of runways are the most critical areas from the standpoint of aircraft use. Pavement failures have occurred in these areas while pavements of the same type and thickness on the runways have shown no signs of distress. Responsibility for this condition is laid to the numerous repetitions of load due to channelization of traffic in these critical areas as compared to the wide distribution of traffic on runways.

If taxiways serving 90,000-lb gross loads are to be surfaced with flexible bituminous types of pavement, the thickness of the surface course is kept the same as that of the runways. But, as in the case of concrete, the total thickness of the taxiways is made greater than that of the adjoining runways. The additional depth required for the taxiways is provided by adding 2 in. to the thickness of the base course and another 2 in. to the subbase over which the base course is laid. Thus for 90,000-lb plane loads, the base courses are usually made 4 in. thicker under taxiways than under the main portions of runways when flexible surfacing materials are used.

Exceptions to this general rule are made when a bituminous pavement is laid on a subgrade consisting of soils having a higher-than-usual supporting power. In such cases, the greater thickness required on taxiways is limited to the two additional inches in the base course. This procedure is recommended because subbases are not required under bituminous taxiway or runway pavements which rest on high-quality subgrades consisting of clean, coarse granular soils such as sand or gravel.

When rigid pavements are used, the added thickness of 2 in. for taxiways is placed in the concrete itself. This difference in the point of placement of the added thickness has an important bearing on cost as it determines what types of materials will be required in larger quantities.

Engineers' Notebook

Charts Aid in Solving Problems of Flow in Open Channels

CLARENCE FREEMAN

Engineer, Bureau of Reclamation, Denver, Colo.

SOLUTION OF PROBLEMS requiring the determination of water-surface profiles in open channels usually involves laborious computations, often of the trial-and-error variety. Presented here are procedures for the construction of two nomographs or alignment charts that can eliminate much of the slide-rule work required for these computations. Limitations of space will not permit development of a theoretical approach to the construction of these charts; however, knowledge of the theory is not essential and the somewhat abridged explanation of how the charts are prepared should be sufficient to enable the engineer to set up similar charts encompassing the particular ranges of channel dimensions and discharges in which he is interested.

No departures from established hydraulic theory are suggested, but rather, by means of the diagrams, graphical solutions of the velocity head and Manning's friction slope for a given trapezoidal channel are made possible.

TABLE 1. TYPICAL BACKWATER COMPUTATION USING VELOCITY-HEAD AND K_f DIAGRAMS, FIGS. 1 AND 2

GIVEN: Bottom width, 40 ft; Side slopes, 1:1; $Q = 15{,}000$ cfs; invert horizontal at El. 100.0; friction coefficient, $n = 0.025$.

Station	Length	Depth	Velocity	$V/2g$ from Fig. 1	K_f from Fig. 2.	$S_f = K_f \times V^2/2g$	S_{Av}	h_f, $S_{Av} \times L$	Assumed El. Energy Gradient	Computed El. Energy Gradient
0 + 00		27.8	8.0	1.0	0.000460	0.000460			128.8	128.80
	1,000						0.000442	0.44		
10 + 00		28.3	7.8	0.94	0.000450	0.000423			129.2	129.24
	1,000						0.000410	0.41		
20 + 00		28.7	7.6	0.90	0.000440	0.000396			129.6	129.65

The velocity head is obtained directly from the diagram shown in Fig. 1 by means of the two solution lines shown, and the friction slope is obtained by solving for the friction slope factor K_f from the diagram shown in Fig. 2 with a single setting of a right triangle using the two legs with the vertex on the depth scale as shown. The friction slope S from Manning's equation is then the product of the velocity head and K_f. Table I is a typical backwater computation illustrating the procedure for utilizing the diagrams. Note that only two multiplications are required per line.

The basis of the chart for determining the velocity head in the channel, Fig. 1, is the formula for the area of a trapezoidal channel of equal side slopes,

$$A = d(b + zd)$$

where A is the area in square feet, d the depth in feet, b the bottom width and z the side slopes (that is, $z = 2$ for slopes of 2 horizontal to 1 vertical).

Construction of Velocity-Head Diagram

Figure 1 illustrates the method of construction of the velocity-head diagram and shows the use of the plotting equations. These equations are as follows: For the area grad-

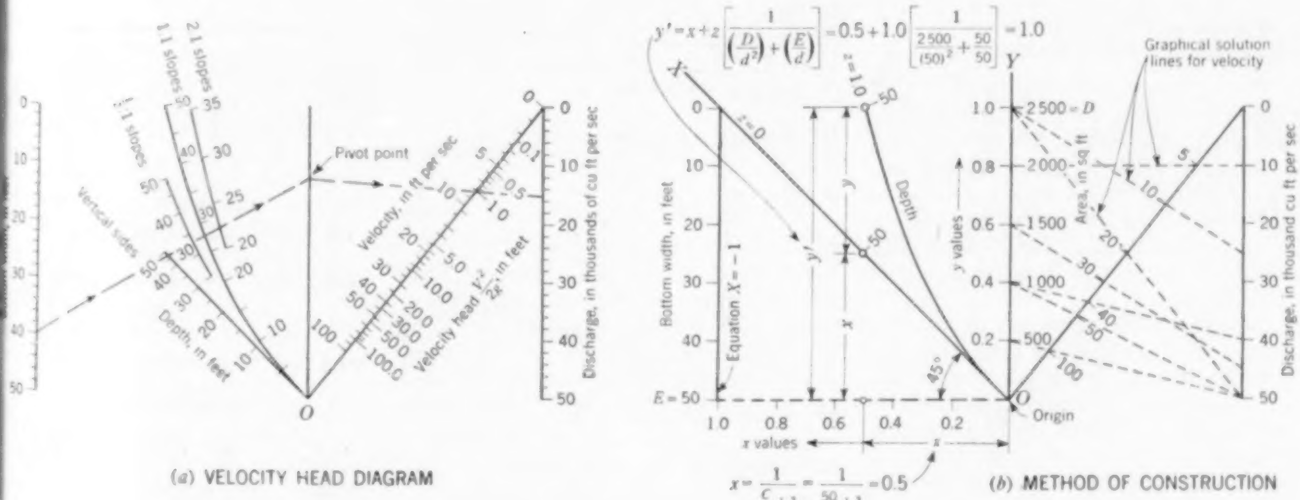


FIG. 1. NOMOGRAPH GIVES VELOCITY HEAD directly by means of two solution lines. First solution line determines area of trapezoid and second solution line, pivoted about area point, divides discharge by area to give velocity and corresponding velocity head, $V/2g$.

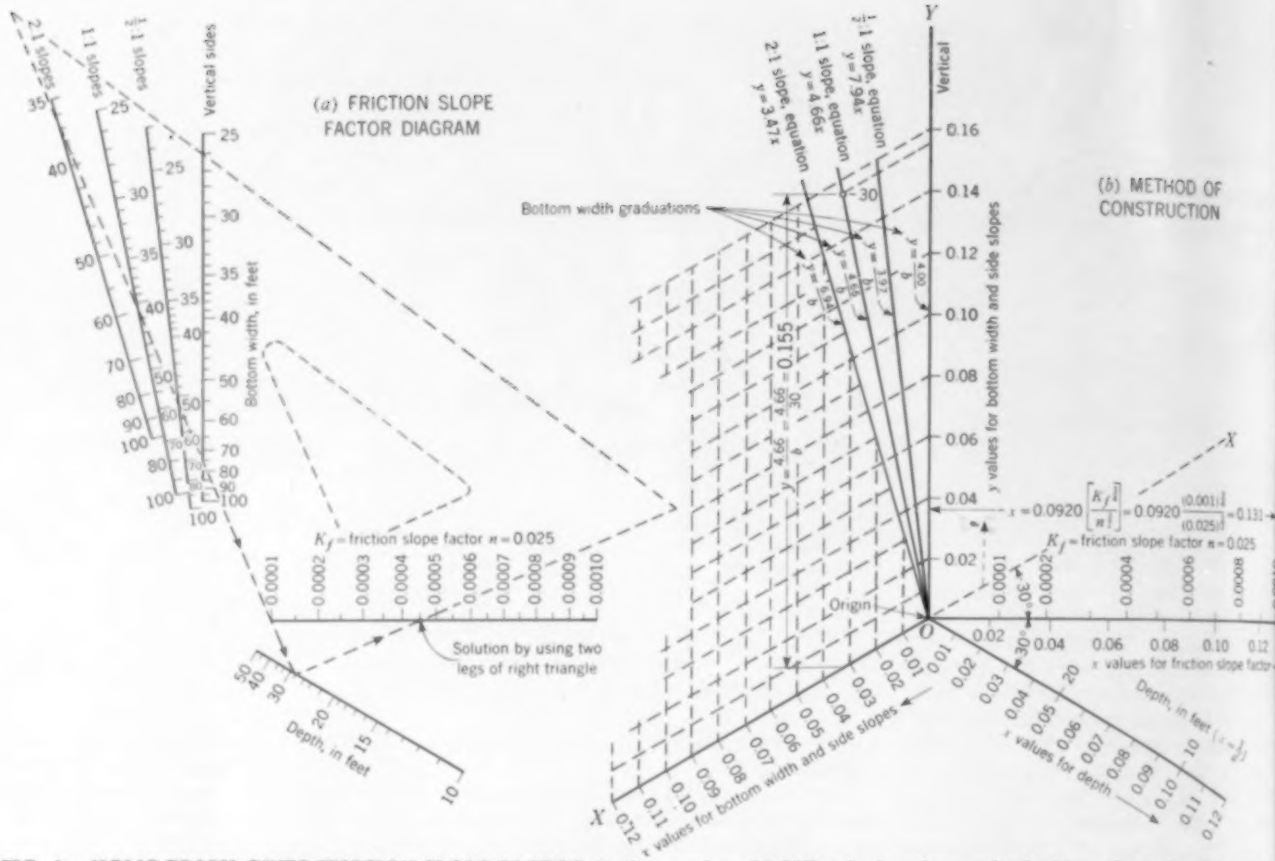


FIG. 2. NOMOGRAPH GIVES FRICTION-SLOPE FACTOR K_f (for n value of 0.025), which is then multiplied by velocity head determin from Fig. 1 to give friction slope S in Manning's equation. Friction-slope factor K_f is obtained by single setting of right triangle using tw legs with vertex on depth scale as shown. Graduations of curve net are plotted from equations in Table II.

uations, $x = 0, y = A$; for the bottom-width graduations, $x = -1$, $y = -b$; and for the side-slope depth graduations,

$$x = -\frac{1}{\frac{C}{d} + 1} \qquad y = x + z\left(\frac{1}{\frac{D}{d^2} + \frac{E}{d}}\right)$$

where

C = ratio of area scale to scale of bottom width
D = range of A scale per x unit
E = range of b scale per x unit

For instance referring to Fig. 1, if the length of the x unit is 10 in., if the bottom-width scale is 5 ft per in., and if the area scale is 250 sq ft per in., then C equals 250/5 or 50, D equals 5×10 or 50 and E is the product of 250×10 or 2,500. Note that the angle between the coordinate axes XOY is 45 deg.

The area scale need not be permanently graduated since it merely defines an intermediate solution point. The first solution line determines the area of the trapezoid, and the second solution line, pivoted about the area point, divides the discharge by the area to give the velocity and corresponding velocity head. The velocity-scale graduations can be most conveniently found by graphical construction as shown in Fig. 1, and the velocity-head values can then be placed opposite the appropriate velocities.

Diagram for Friction Slope Factor

The nomograph for the friction slope factor, Fig. 2, is based on a diagram for the hydrualic radius of a regular trapezoidal canal designed by R. Soreau and originally published in *Nomographie ou Traité des Abaques*, Vol. 1. The development of the diagram is as follows:

$$\text{Hydraulic radius, } R = \frac{\text{Area}}{\text{Wetted Perimeter}}$$

$$\text{or} \quad R = \frac{d(b + zd)}{b + 2\sqrt{1 + z^2}\ (d)}$$

which Mr. Soreau demonstrated can be written in proper nomographic form after some algebraic manipulations. The plotting equations for the side slopes and bottom widths produce a curve net composed of radiating lines $y = (1 - 4\sqrt{1 + 1/z^2})\,x$ and curves $y = x + 4\sqrt{x^2 + \frac{1}{b^2}}$. Graduations of the curve net can be determined by the plotting equations shown in Table II.

The friction slope factor K_f i derived from Manning's equation fo flow in open channels.

$$V = \frac{1.486}{n} R^{2/3} S^{1/2}$$

where

n = roughness coefficient
R = hydraulic radius
S = friction slope

TABLE II. PLOTTING EQUATIONS FO DETERMINING GRADUATIONS O CURVE NET FOR NOMOGRAPH O FRICTION-SLOPE FACTOR, FIG. 2

Side Slopes	Equation of Radiating Lines	Bottom-Width Graduation
4:1	$y = -3.15x$	$y = \frac{12.60}{b}$
3:1	$y = -3.22x$	$y = \frac{9.66}{b}$
2:1	$y = -3.47x$	$y = \frac{6.94}{b}$
1½:1	$y = -3.81x$	$y = \frac{5.71}{b}$
1:1	$y = -4.66x$	$y = \frac{4.66}{b}$
½:1	$y = -7.94x$	$y = \frac{3.97}{b}$
¼:1	$y = -15.49x$	$y = \frac{3.87}{b}$
Vertical	$x = 0$	$y = \frac{4.00}{b}$

Transposed and multipled by $2g$ he formula becomes

$$S = \left(\frac{n^2 2g}{2.208R^{4/3}}\right)\frac{V^2}{2g}$$

The quantity in brackets is the friction slope factor K_f. By eliminating R from the plotting equation $x = \frac{1.153}{R}$ and the expression for K_f shown above, the final plotting equation for the K_f graduations, $x = 0.0920 \frac{K_f^{3/4}}{n^{3/2}}$ results. Values of this function have been plotted in Fig. 2 for an n value of 0.025. The depth graduations are determined by the equation $x = 1/d$.

Figure 2 shows the interrelation of the various functions and the method of construction of the friction slope factor diagram.

Frequency Factor Is Applied to Highway Bridge Live-Load Stress Computations

LARENCE D. BOWSER, M. ASCE
Designing Engineer, Bureau of Bridges, State Department of Highways, Columbus, Ohio

HROUGH THE YEARS, highway bridge engineers have progressively revised the assumed live loadings to keep pace with changing conditions. Today they use a single andard truck (or tractor with semi-ailer), or a corresponding lane load hich is calculated to simulate actual ucks or truck trains. In zones of enser traffic where heavy vehicles ass more frequently, the greater umber of stress fluctuations is assumed to be provided for by the use f heavier assumed live loads. Taking for example the specifications of e American Association of State ighway Officials, H15-S12 would be e usual loading employed, but 20-S16, one-third heavier than H15-12, would be applied in an area with ense traffic.

A more rational system of loads ould be provided by assuming a andard truck or lane load which pproximates the maximum legal ad, and then taking care of high-ensity traffic and the resulting eater number of passages of the sign load during the estimated life the structure by applying a frequency factor or maximum stress cle factor, preferably to the unit ress. Every structure on a highway system may be subjected to the aximum legal load, either a few or any times. The design should provide, in a safe yet economical way, r the proper number of repetitions that load. Different parts of a ructure may require different factors. For example, during the passage of the design truck, transverse or beams would be subjected to o heavy axle loads whereas longitudinal trusses or girders would be essed the maximum amount but ce.

The value of the frequency or maximum-stress-cycle factor will depend, first of all, upon the total number of passages of the design load during the estimated life of the structure. A. A. Jakkula and Henson K. Stephenson[1] have estimated that we may expect an average of 6,600 heavy freight vehicles (the design load) per year per 1,000 vehicles of all types per day. The product of 6,600, the estimated life of the structure in years, and the probable average daily traffic count (in thousands) is the probable total number of cycles that the structure may be called upon to withstand. For this discussion 100,000, 600,000 and 2,000,000 cycles are cited as convenient for use.[2] The additional effect of cycles beyond 2,000,000 becomes less and less.

It is impossible to make full allowance for the effect of repetition of stress without considering the amplitude of the fluctuations. Thus, if the repeated stress fluctuates from the maximum through a complete reversal, say 100,000 times, much more damage may result than if the amplitude varies from the maximum to only slightly less than the maximum through 2,000,000 cycles or even an infinite number of cycles.

[1] Progress Report No. 5, Heavy Vehicle Series, Public Roads Administration and the Agricultural and Mechanical College of Texas, 1945.

[2] Publications of the Committee on Fatigue Testing (Structural) of the Welding Research Council of the Engineering Foundation, particularly Report No. 3, 1943, Report No. 4, 1945, and Report No. 5, 1945, and the American Welding Society's Standard Specifications for Welded Highway and Railway Bridges, 1947.

Study of this matter of the number and amplitude of the cycles of fluctuating stress[2] has suggested the reduced structural steel unit working stresses indicated by the following formulas, in which the basic unit stress is 18,000 psi:

For 100,000 cycles,

Maximum = 18,000 + 1/2 minimum (but not more than 18,000)

For 600,000 cycles,

Maximum = 15,000 + 1/2 minimum (but not more than 18,000)

For 2,000,000 cycles,

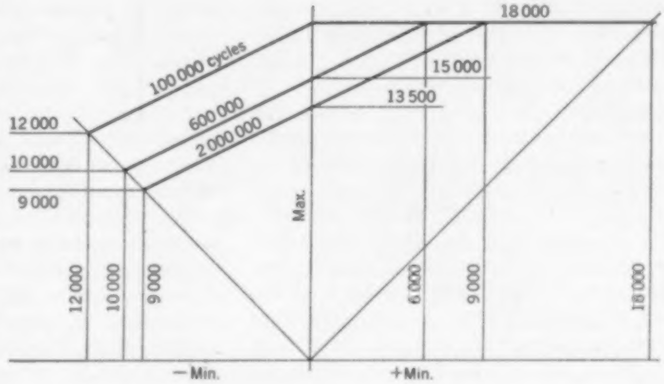
Maximum = 13,500 + 1/2 minimum (but not more than 18,000)

These formulas are plotted in Fig. 1 to give a picture of the effect of a change in either the number of cycles or their amplitude. Maximum stresses (the numerically greater stresses) are measured vertically from the base line. Minimum stresses (the numerically smaller) are measured horizontally in either direction from the center axis. If the minimum is of the same sign as the maximum, it is used as a plus quantity and measured to the right of the reference axis. Likewise, if the minimum is of a sign opposite to that of the maximum, it is used as a minus quantity and measured to the left of the axis.

To apply the foregoing to highway bridge loadings, suppose that a struc-

(Continued on page 80)

FIG. 1. CURVES SHOW effect of change in either number of cycles or their amplitude in computing live-load stresses in highway bridges. Maximum stresses (those numerically greater) are measured vertically from base line. Minimum stresses are measured horizontally in either direction from center axis.



... THE READERS *Write*

Discharges Given for 1948 Floods on Rio Grande

To the Editor: Statistics on the recent Rio Grande floods may be of interest to readers of Civil Engineering. The extreme drought which harassed the Lower Rio Grande Valley during the spring and early summer was broken suddenly in late June by a flood of outstanding magnitude on the Rio Grande from Del Rio to the Gulf of Mexico. Preliminary data indicate that the gage heights and discharges experienced throughout most of the reach of the river have been exceeded only once within the recorded history of the stream—during the record-breaking flood of 1932.

The storm which produced the recent flood centered adjacent to the Balcones escarpment along the eastern divide of the Devils River watershed, where it joins the basins of the minor tributaries that drain into the Rio Grande east of Del Rio, Tex. Rainfall recordings made by ranchers and other interested persons in the district show that from 25 to 30 in. fell over a wide area, most of it within a period of less than 24 hours.

In the vicinity of Del Rio the rise was sharp. At 10 o'clock on the morning of June 24 the discharge was slightly under 1,200 cfs—approximately the same as it had been running for several weeks. By 2 p.m. it had risen to 48,000 cfs, and at 11 p.m. it reached the peak of 485,000 cfs. The peak discharge on the Devils River, a stream draining 4,185 sq miles, occurred on the 24th, reaching a crest of 460,000 cfs. This rise disrupted the operation of two hydroelectric power plants and a steam power plant of the Central Power and Light Co., and destroyed the main railroad crossing of the Southern Pacific Railroad. A second peak on July 5 destroyed the rebuilt railroad trestle.

At Rio Grande City, Tex., approximately 100 miles downstream from Laredo, the discharge on June 24 was 640 cfs, an amount not greatly in excess of the all-time low that was reached earlier in the summer. On June 29 the flood peak of 150,000 cfs reached this station. Preliminary figures for peak discharges at stations along the Rio Grande are given in Table I.

High-water marks set on some of the smaller tributaries far exceeded anything heretofore noted in that area. For instance, Sycamore Creek, which drains an area of only 515 sq miles, and had an estimated discharge of 215,000 cfs in June 1935, set high-water marks several feet above those previously established, destroying a building reported to have been on its bank for 75 years.

It is expected that damages will be high when complete estimates of losses are available. Agriculture, particularly livestock, highways, railroads, and public utilities suffered acutely.

TABLE I. PEAK DISCHARGES AT STATIONS ON RIO GRANDE

Station		1948* Discharge, cfs	1932 Discharge, cfs
Devils River	June 24	460,000	557,500
Del Rio, Tex.	June 24	485,000	604,300
Eagle Pass, Tex.	June 25	514,000	568,630
Laredo, Tex.	June 26	295,000	402,500
Zapata, Tex.	June 27	223,000	261,160
Roma, Tex.	June 28	190,000	203,420
Rio Grande City, Tex.	June 29	150,000	198,730

* 1948 figures tentative.

Because the Rio Grande is an international stream, forming the boundary between the United States and Mexico, a complete investigation of the flood, its cause and effects, has been started by the International Boundary and Water Commission, which has its headquarters in El Paso. As soon as the necessary information can be assembled, a detailed report will be issued.

L. M. Lawson, Hon. M. ASCE
Commissioner, International Boundary & Water Commission United States & Mexico

El Paso, Tex.

Clarification of Society's Policy Statement Sought

To the Editor: The interest in public engineering practice taken by the Board of Direction at its April meeting is commendable and the propounding of its seven-point Statement of Policy, printed in the May issue, most impressive. Although I realize that a policy such as this must be stated in very broad terms for general application to a multitude of situations, I feel that certain points need clarification and modification.

In Article 2 of the policy statement, reference is made to engineers employed by the technological departments of our state universities in a statement that "The Society does not approve of such engineers maintaining a private office and a staff either by themselves or with others in direct competition with engineers not in public employ." It may be contended that since an engineer employed by a state university is paid from public funds, his competition with a private firm is unfair; or that since he receives office service, library, and student assistance at little or no expense to himself, his competition is unfair.

Perhaps this is so. On the other hand, we must consider the grave urgency of maintaining on our university faculties engineers with an active, first-hand knowledge of practice. All too frequently the university-employed engineer is criticized for being impractical, yet he is denied the opportunity to correct his deficiency. From the tenor of Article 2 it appears, however, that some state universities have been fortunate enough to obtain the services of high-caliber men who are much in demand as consultants by clients who prefer to get the "dope" direct from the "master" rather than rehashed by lesser men. The precept that an engineer should be paid according to his ability cannot be the subject of legislation either by a society or anyone else if the principles of free competition are followed.

In Article 5, it is stated: "The Society has observed that, frequently, certain governmental agencies have engaged in promotion of, and negotiations for, engineering work of irrigation, drainage, land reclamation, power, water supply, air

ports, housing and other projects to the end that the engineering staffs of the agencies may be continuously employed. The Society does not believe that the best interests of the public are served in many of these instances, especially in the medium and smaller-sized projects, and will use every effort to discourage similar practices in the future." It may be contended that promotion of, and negotiations for, engineering work of irrigation, drainage, land reclamation and power are conducive to overdevelopment, to opening new areas of production for which no firm markets are immediately available, or that governmental agencies are diverting engineering work from private engineering firms to the adverse interests of the public.

On the other hand, consider the prime importance of developing the resources of the West. Examine the many fields of engineering and agricultural science that are involved in location, layout, and design of an irrigation system. The ruins of poorly engineered or poorly planned irrigation projects all over the West amply demonstrate the fallacy that small and medium-sized projects do, of necessity, present fewer problems to the engineer than do larger projects. Certainly such failures are not in the public interest. If governmental agencies have specialist engineers available to do such work on large projects, the use of these engineers on other projects would seem desirable inasmuch as a better project would result.

J. E. Mandry, Assoc. M. ASCE
Denver, Colo.

Bureau of Yards and Docks Designer of Inyokern Lab

Dear Sir: In the interest of completeness, I should like to give additional information on the Naval Ordnance Test Laboratory at Inyokern, Calif., which was described in the June issue of Civil Engineering.

The Michelson Laboratory was designed by the Design Section of the Bureau of Yards and Docks under the general supervision of Rear Admiral John J. Manning, M. ASCE, CEC, USN, chief of the Bureau. Capt. H. L. Mathews, CEC, USN, served as officer in charge of construction, and the general contractor was Johnson, Drake & Piper, Inc., of Oakland, Calif.

S. F. Stowe
Director, Training & Information Division, Bureau of Yards and Docks
Washington, D.C.

Additional Data on Inyokern Research Laboratory Given

To the Editor: Readers of Civil Engineering will undoubtedly be interested in a few additional facts to supplement those given in the article, "Navy Dedicates New Research Laboratory at Inyokern, Calif.," in the June issue. Several items which the writer considers worthy of mention are presented here.

The Laboratory was dedicated to national defense and named in honor of Dr. Albert A. Michelson, noted American physicist, by Dr. C. B. Milliken, eminent professor of physics, emeritus, of California Institute of Technology. The contract for the project was awarded five months after the Jap surrender in 1945. The Navy Bureau of Yards and Docks, where the project was designed and under whose direction it was constructed, determined that the laboratory was of vital national importance and not merely a wartime exigency. The contract for its construction was therefore awarded on a competitive bid basis to the lowest acceptable responsible bidder Johnson, Drake and Piper, Inc., general contractors.

Construction work, started in January 1946, was carried on under unusual difficulties. The laboratory is located in the Mojave Desert in Southern California, where the daytime temperatures rise at times to 140 deg in the shade, but there is no shade. Sand storms in this region last for days, blasting the paint off equipment and all other exposed surfaces, filling lungs, eyes, homes and food with grit. Cloudbursts often flooded the works, wrecked roads, impaired buildings, and at times even damaged the Los Angeles Aqueduct, the main source of water supply for that city.

The project was built during the so-called reconstruction period following World War II when the labor and materials supply was chaotic. With the removal of government control on labor and materials, costs increased greatly. Procurement became difficult. Since thousands of tons of specialized materials and equipment were purchased from all over the nation for the project, labor disturbances and transportation problems in all parts of the country affected the work.

It was with a realization on the part of the government and contractors' forces that this important work must be completed as soon as possible, that every effort was expended to build these facilities for those who would use them to further national knowledge for our safety. Thus occupation of portions of the facilities was effected as soon as they were available, about eight months before the final completion and acceptance of the entire construction program. Dedication of the project on May 7, 1948, was the culmination of an exhausting postwar effort of war-weary personnel of the U.S. Navy Bureau of Yards and Docks, and one of the largest and best known construction contractors.

Richard F. Weske, M. ASCE
Berkeley, Calif.

Reports on Engineering Conditions in Germany

To the Editor: On a recent trip to Germany for study of the wartime destruction of masonry and earth dams I discovered some factors in the European Recovery Program that may illumine the problems involved.

Since European recovery is based to a large degree on the production of coal and coke in the Rhur Valley, the ERP is endeavoring to increase the output of these products. However, each ton of coal produced requires 2.5 tons of water, and each ton of coke 5 tons of water. Furthermore, from 10 to 22 tons of water are needed for the production of each ton of pig iron. If the production of synthetic gasoline is resumed, from 75 to 95 tons of water will be required for each ton of gasoline produced.

In the Ruhr Valley this water demand is supplied by a series of storage reservoirs integrated into a single system. Two of the key dams, the gravity-type Moehne Dam and the earthfill Sorpe Dam, were destroyed during the war, but are now repaired. The valleys of the Ruhr River are well forested, so that the natural retention capacity of the ground nearly equals the retention capacity of the reservoirs. This natural retention is therefore of vital importance to the production of coal, coke, and iron.

Now, however, the Belgian occupation forces, as part of the reparation costs, are cutting these forests, though most of the trees are only 6, 8, or even 4 in. in diameter. Entire mountain sides are being literally denuded, with consequent soil erosion and destruction of the storage capacity of the soil. To offset the loss of water storage, new reservoirs are contemplated. Dams create heads, which means that new hydroelectric power plants will be built. However, new power plants mean new capacities for military production, which is against American policy.

At the same time, the French demand the production of more coal, which requires more water. The Ruhr is, however, in the British Zone of Occupation, thus completing the vicious circle of conditions to be found in Germany today.

Joseph D. Lewin, M. ASCE
Brooklyn, N.Y.

SOCIETY NEWS

President Dougherty Discusses Dues Amendments and Clarifies ASCE Aims and Activities

Annual Address Stresses Cooperation with EJC and Other Organizations

In addition to discussing the proposed dues increase, as reported in last month's issue of Civil Engineering, President R. E. Dougherty touched upon other Society affairs in his Annual Address delivered at the opening session of the ASCE Summer Convention in Seattle. Among them were the relationship between the two Constitutional Amendments on which the Society's members are balloting this fall; the differential in dues now favoring those residing outside District 1; the value of the field offices maintained by the ASCE in Washington, D.C., Chicago, Ill., and Los Angeles, Calif.; the need for stating clearly the aims and intents of the Society; and the advisability of close cooperation between the ASCE and other engineering organizations.

Following are additional excerpts from President Dougherty's Annual Address which time limitations made it impossible to use in the August issue of Civil Engineering:

"A *second amendment, based on Petition No. 2*, has been similarly prepared and presented to the effect that:

> 'The annual dues payable by Members, Associate Members, Affiliates and Junior Members within District No. 1, shall be the same as those payable by corresponding members residing outside District No. 1.'

"This amendment would accord to the membership in District No. 1 the same treatment as that enjoyed by the rest of the Society. Please note most carefully that the second amendment is to be made effective *only* if the first passes.

"I shall endeavor to present a factual analysis of Petition No. 2 and the accompanying amendment.

"Many members residing outside of District No. 1 may have the idea that the differential now existing should continue, although others consider it to be an inheritance of past thinking, when the activities of the Society primarily centered in the old building at 57th Street and before the days of Local Sections. In those days there was an advantage, although now largely dissipated as a sequel to the transfer of activity from 57th Street to the Engineering Societies Building and the initiation of Local Sections. The Metropolitan Section pays for the use of its rooms in the Engineering Societies Building.

"None of the other Founder Societies makes any distinction as to dues charged to members in the Metropolitan area as against the rest of the membership.

"Geographical expediency necessitates calling upon the membership in District No. 1 for the brunt of such work as membership on United Engineering Trustees, Engineering Foundation, Engineering Societies Library, consideration of questions involving securities and investments, the recurring responsibility for the Annual Meetings, and other duties of a similar character.

"On the other hand, I have heard it stated that this is one of the distinct advantages for service to the profession which is enjoyed by members in District No. 1, less available to members living at greater distances. It has also been stated that it is an advantage to the membership of District No. 1 to have the Annual Meetings in New York.

"It is sometimes claimed that there is a distinct advantage in close contact with the Engineering Societies Library. Analysis indicates that a large proportion of the service, possibly 60 percent, at least is furnished to the membership outside of New York State, let alone District No. 1. Furthermore, the service rendered by the Library is primarily of advantage to employing organizations rather than to individual members.

"I have endeavored in the foregoing to present impartially the various arguments for and against, and will leave it otherwise for you to strike the proper equation.

"The question has arisen as to whether we should eliminate the field offices, particularly the two in Chicago and Los Angeles. A careful review of this question by the Board and discussion with both presidents and members of many Local Sections, including the coordination of these considerations by the Vice Presidents and Directors of Zones III and IV, leads to the inescapable conclusion that Messrs. Jessup and Salter are serving a most useful purpose, particularly in dealing with the Local Sections, Juniors and Student Chapters. It must be remembered that we are a far-flung organization and although the initiation of the idea originally, largely but not entirely, had to do with collective bargaining, nevertheless, that is now very much of a minor consideration in so far as time is concerned and their only functioning in that respect has to do with keeping headquarters posted as to what is going on in their respective territories. I have never heard anyone raise the slightest question as to the necessity for the Washington office. The service of E. L. Chandler in keeping the Board and the Executive Secretary posted as to legislation and other federal activities, as well as his other work in connection with the Local Sections, Juniors, etc., has justified that position in the eyes of everyone familiar with this work. One has only to discuss that particular subject with the District of Columbia Section to realize the appreciation that we should extend to Mr. Chandler.

"There was a great deal of confusion for several years in connection with collective bargaining, and the 1943 Board

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Ballots Circulated on Amendment of ASCE Constitution

BALLOTS HAVE BEEN sent to the membership of ASCE for a decision on amendment of the Constitution of the Society. The amendments which have been petitioned by the membership pertain to the increase of Society dues and to the equalization of the existing dues differential.

All voting members desiring to express an opinion should vote on the ballots and return them as promptly as possible. Ballots will be canvassed at Society Headquarters at a business meeting of the Society called for October 1, 1948 (see page 57). To be counted, ballots must be received on or before the date of this meeting.

came in for considerable criticism when it took cognizance of that very controversial issue, particularly acute as it involved the membership of the Society in the Western, Central and Southern states and, to a more limited extent, in the East. Any pioneer movement in an uncharted field is bound to be accompanied by certain actions which subsequently have to be modified and this instance is no exception. Like most of you, I was not too familiar with its ramifications when I came back to the Board as a Vice-President in 1944. While the original procedure had to be radically changed, nevertheless, the 1943 Board was faced with a very serious situation and I am convinced that, controversial though the subject and procedure may have been, the Society owes a debt of gratitude to that Board for its courage in endeavoring to meet a critical problem. I firmly believe that its action, by the very differences of opinion that arose out of it, focused active attention on the subject in a way that could hardly have been accomplished otherwise. Fortunately the Taft-Hartley Act has eliminated some of that worry, but there are even presently problems in that same connection that must be watched carefully. Is there anyone who will argue that careful attention to national legislation and policy should not be given the direct and continuing consideration of our Society in cooperation with others involved?

"The question has been raised with me on several occasions that we should more clearly state the aims and intent of our organization. In casting about to develop that suggestion, I find that some of the Sections, following the leadership of the Kentucky and Illinois Sections, are using a statement of reasons for membership that I would be willing to adopt as a platform. You will find this effort more fully outlined on the editorial page of the July issue. I quote:

'To encourage and perfect discoveries in basic and applied science and to bring these discoveries to all members of the profession, it has published technical papers and discussions.

'To stimulate professional activity at the local level, it has created and supported local sections.

'To afford the beginnings of professional associations in universities and colleges, it has established and encouraged student chapters.

'To advance the economic standing of the profession, it has formulated and adopted classification and compensation schedules for civil engineering positions.

'To encourage the payment of higher salaries by employers, it has recommended adequate fees for consulting engineering services.

'To foster the professional standing of its members, it has promoted national registration laws.

'To improve engineering education standards, it has cooperated with other national engineering societies in the accrediting of engineering curricula.

'To free its members from enforced collectivism, it has taken effective action on national labor legislation affecting the profession.

'To the older engineer, membership in the Society provides the professional associations and contacts by which success in his profession usually has been attained.

'To the Junior engineer, membership is the medium for providing wider sources of technical information, more varied personal relations, and less formal contacts with his superiors than he usually finds in his daily work.

'And to all engineers, membership in the Society carries a recognition of professional standing in a degree second to no other organization.'

"In order better to meet the many problems before us, it was wisely concluded about four years ago to cooperate actively with the Electricals, Mechanicals, Miners and Chemicals in the formation of what is now known as Engineers Joint Council, which presently consists of the President, immediate Past-President and Secretary of each organization. This combination is actively watching over the general affairs of the profession from a national and international standpoint and in company with other organizations. The general provisions of its Constitution were approved at a meeting of the Council on July 8 and at this meeting of your Board of Direction, and may be stated as follows:

"The objectives of the Council shall be:

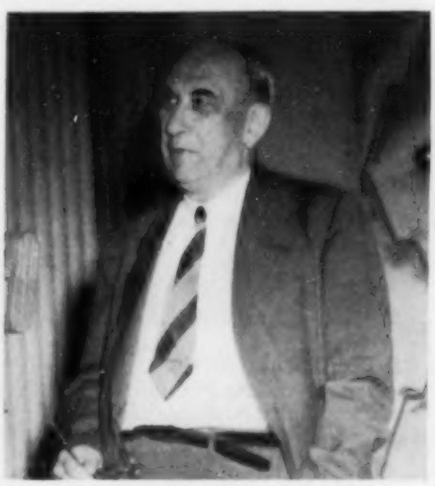
(*a*) To advance the general welfare of mankind through the available resources and creative ability of the engineering profession.

(*b*) To promote cooperation among the various branches of the engineering profession.

(*c*) To develop sound public policies respecting national and international affairs wherein the engineering profession can be helpful through the services of the members of the engineering profession.

"An EJC Committee has been created consisting of one member appointed by each Constituent Society to prepare a plan for the increased unity of the engineering profession.

"Let me emphasize the advisability of a more intensive cooperation with other organizations than those now included in


PROMINENT ENGINEERS ADDRESS SEATTLE CONVENTION. Shown (left to right) are Reginald H. Thomson, Honorary Member and former Director of Society, Seattle, who spoke briefly at Wednesday luncheon meeting; ASCE President R. E. Dougherty, who delivered Annual Address at general membership meeting on Wednesday morning; and Col. O. E. Walsh, district engineer for Army Corps of Engineers, Portland, who gave timely talk on Willamette Valley Flood Control Project before Construction Division.

Engineers Joint Council. Colonel Carey and I have conferred with President Winkelman and Executive Director Foreman of the Associated General Contractors, and our Board has just authorized the designation of a joint committee to work with the Associated General Contractors with the objective of close cooperation. I certainly hope the day will come when there will be complete understanding among the various engineering organizations that should have the same eventual purpose in mind.

"I have heard the statement made that the Society 'is at the cross-roads.' I am not inclined toward such a comparison. I am more given to an analogy with travel on a highway as it may have existed in 1921, probably not more than two lanes in width and lucky if even of gravel or macadam. But that same highway is now of four or six lanes.

"I cannot help but compare the 'brass-nosed flivvers' and similar automobiles of those days with the equipment that we now enjoy.

"I sincerely hope that the membership will permit its Board to operate with what corresponds to a modern automobile on an improved through thoroughfare, and not require us to attempt to keep our proper place among the professions with out-of-date equipment or outmoded concepts. The days of the 1921 roads and motor vehicles have gone. Cross-roads? NO! The same road of the engineering profession modernized and a road upon which I hope we may travel with up-to-date equipment."

ASCE Seeks NLRB Directive Assuring Professional Employees Bargaining Freedom

UPON RECOMMENDATION OF the ASCE Committee on Employment Conditions, steps have been taken through the office of the Eastern Representative, ASCE, to obtain inclusion of a specific directive to regional directors of the National Labor Relations Board aimed at obtaining uniform procedure assuring professional employees the privilege of deciding whether they will or will not be included in a heterogeneous labor unit or be represented by any collective bargaining agent.

In a recent report to the Board of Direction, the Committee on Employment Conditions asserted it "is disturbed by the fact that the rules and regulations of the NLRB contain no directive to the regional directors requiring them to conduct separate elections to determine the wishes of professional employees in respect to their inclusion in a heterogeneous unit." Such omission, the committee pointed out, "may greatly increase the difficulties of professional employees in obtaining the privilege of self-determination of their collective bargaining status. The rules and regulations of the NLRB should be amended to include a directive to NLRB regional directors requiring them to determine that no professional employees are included in a heterogeneous unit, and that they hold elections at the request of any group of professional employees to determine whether they will or will not be represented by any collective bargaining agent."

From the NLRB office in Washington, it has been ascertained that in elections which are directed by the NLRB there is an express exclusion of professional employees, but that it is possible that in consent elections, which are not preceded by a direction of election, but simply by a stipulation prepared by one of the NLRB field officers occasionally the voting lists submitted may have included professional employees.

It has been ascertained further that the NLRB and its regional offices will recognize that if professional employees have been inadvertently included in such elections, they are not bound by the results thereof, and the winning union is not entitled to include them in its contract or represent them for collective bargaining.

Through the office of the Eastern Representative, ASCE, it has been suggested to the NLRB that its manual of operations for the regional offices might well contain some specific instruction on this question for the benefit of the field staff.

S. S. Steinberg to Represent EJC at Bogota Conference

S. S. STEINBERG, M. ASCE, dean of the University of Maryland College of Engineering, will represent EJC at a conference in Bogota, Colombia, on November 11, at which plans will be made for the first Pan-American Engineering Congress, which is scheduled to convene in Rio de Janeiro, Brazil, in 1949.

Dean Steinberg is in South America completing a survey of engineering education at request of the State Department.

COMMITTEE ON ARRANGEMENTS FOR ASCE SEATTLE CONVENTION, consisting of chairmen of various local committees, is pictured on steps of newly completed civil engineering building at University of Washington. Shown, front row, left to right, are: Neil Lane, Robert Leaver, Cotton Howard, B. P. Thomas, president of Seattle Section, Prof. F. B. Farquharson, and Richard Tyler; second row, Alfred L. Miller, Prof. Fred H. Rhodes, Jr., general chairman of Committee on Arrangements, Prof. Frederick Smith, Homer Hadley, Dudley Stevens, and Walter E. Jessup, ASCE Western Representative; third row, Capt. C. F. Ganong, Edwin L. Strandberg, Arthur Owley, Thomas Campbell, Cecil Arnold, James Reid, R. M. Murray, and Nat Carle. Other members of committee, not present when photo was taken, are Ernest Crane, Walter Averill, and George Teufel.

Scott B. Lilly, Candidate for Vice-President, Dies

THE SUDDEN DEATH of Scott B. Lilly, candidate for ASCE Vice-President, Zone II, and chairman of the engineering division at Swarthmore College, on August 19, will come as a shock to his many friends in the Society.

Scott B. Lilly

Professor Lilly joined the Swarthmore faculty in 1910 after three years at Cornell University. He remained at Swarthmore until 1917, when he became assistant plant engineer for the Merchant Shipbuilding Corp. Later he was with J. N. Kinney, New York contractor, the Ohio Locomotive Crane Co., and the Florida Rock Products Co., at Tampa. In 1929 he returned to Swarthmore as professor of civil engineering, and since 1936 he had been chairman of the division of engineering. He was co-author of an engineering text, *Applied Mechanics*, and author of several articles in the ASCE TRANSACTIONS.

A member of the Society since 1931, Professor Lilly served as Director from 1942 to 1944. He had served as chairman of the Administrative Committee on Juniors and the Publications Committee, and vice-chairman of the Committee on Salaries. In the Philadelphia Section he held various offices, serving as president in 1939 and 1940. Professor Lilly had been chairman of the Engineers Council for Professional Development Committee on Engineering Training, and had recently been reappointed to a three-year term as ASCE representative on ECPD.

Secretary Carey to Represent ASCE at London Conference

IN RESPONSE TO an invitation from the three principal Engineering Institutions of Great Britain to participate in a conference in London, to be held October 4–6, the ASCE Board of Direction at its Seattle meeting authorized ASCE President Dougherty and Executive Secretary Carey to attend as Society representatives.

The invitation—signed by the presidents of the Institution of Civil Engineers, the Institution of Electrical Engineers, and the Institution of Mechanical Engineers and addressed to the presidents of the corresponding American societies and to the chairman of EJC—states "For some time past, the councils of our three Institutions have felt the need for a more intimate and close exchange of views between the principal officers of engineering societies in Western Europe and America than is possible on the occasion of some international meeting, when other engagements may interfere and prevent as much benefit being derived as would be the case if a meeting were convened solely for the purpose of improving our international collaboration."

President Dougherty has indicated that he will be unable to attend the conference. Dr. L. W. Bass, past-president of the American Institute of Chemical Engineers and present chairman of EJC, and Col. C. E. Davies, secretary of the American Society of Mechanical Engineers, are expected to attend. These two engineers, with Colonel Carey, probably will constitute the EJC representation at the conference.

Society Business Meeting to Be Held October 1

A REGULAR MEETING of the Society will be held in the Engineering Societies Building, 33 West 39th Street, New York, N.Y., on the evening of October 1, 1948, at 7:00 p.m. The sole purpose of the meeting is to canvass the ballots on the proposed amendments to the Constitution in regard to increase of annual dues and equalization of existing dues differential.

This announcement is made in compliance with the requirement of the Constitution that Corporate Members shall receive official notice not less than 15 days in advance of the meeting. No other business will be considered.

New Manager of Chicago Office of ESPS Appointed

JOSEPH R. DECKER has been appointed manager of the Chicago office of the Engineering Societies Personnel Service, succeeding Thomas Wilson who is retiring to private life after 16 years with the Service.

Joseph R. Decker

A former lieutenant commander in the Navy Construction Battalions and chief of Training Facilities for the Veterans Administration, Mr. Decker was for many years engineer and sales representative for a large electrical products manufacturer, with offices in Chicago and Detroit.

WOMEN ENGINEERS GET TOGETHER at ASCE Summer Convention. Miss Ruth V. Gordon, of Seattle (left), chats with Miss Lucy Wilson, Jun. ASCE, engineer for U.S. Bureau of Reclamation at Great Falls, Mont. Miss Gordon is recent graduate of Stanford University, where she was member of ASCE Student Chapter.

NEW YORK CITY VISITORS to Seattle Convention include George G. Kelcey, M. ASCE, and Mrs. Kelcey. Mr. Kelcey is member of consulting firm of Edwards & Kelcey.

ASCE Technical Procedure Committee Has Meeting

ACTIVITIES OF THE various Division committees and other Society matters, in which the Divisions are concerned, were reviewed at a meeting of the Technical Procedure Committee in Chicago on August 6 and 7. The committee reviewed the activities of the present Division committees; decided the policy for size and rotation in office for Division committees; authorized formation of a new joint committee under the sponsorship of the Hydraulics Division to study snow, ice, and permafrost; and authorized appointment of a committee to make a complete study of Society meetings and papers. Tentative Division budget estimates for the next fiscal year were also reviewed by the chairman of the Society's Budget Committee, who attended the meeting.

The Technical Procedure Committee is made up of the Board Committee on Division Activities, the chairman of the Research Committee, and the chairmen or secretaries of the Technical Divisions.

Tellers Canvass First Ballot for 1949 ASCE Officers

August 2, 1948

To the Secretary
American Society of Civil Engineers:

The tellers appointed to canvass the First Ballot for Official Nominees report as follows:

For Vice-President, Zone II

* Scott B. Lilly	911
Scattering	150
Void	0
Blank	13
Total	1,074

For Vice-President, Zone III

Robert B. Brooks	794
† Royce J. Tipton	561
Scattering	158
Void	1
Blank	5
Total	1,519

For Director, District 1

(Two to be elected)	
Waldo G. Bowman	224
Morris Goodkind	220
‡ Ineligible Candidates	58
Scattering	308
Void	2
Blank	28
Total	840
(One half of above figure)	420

For Director, District 2

Harold L. Blakeslee	251
Ernest A. Dockstader	31
‡ Ineligible Candidates	16
Scattering	45
Void	0
Blank	2
Total	345

For Director, District 6

Paul L. Holland	265
‡ Ineligible Candidates	9
Scattering	41
Void	1
Blank	8
Total	324

For Director, District 10

Edmund Friedman	196
† Fred J. Lewis	99
Robert M. Angas	73
Scattering	23
Void	0
Blank	3
Total	394

For Director, District 13

Sidney T. Harding	283
Robert J. Newell	29
‡ Ineligible Candidates	37
Scattering	74
Void	0
Blank	1
Total	424

Ballots canvassed	4,500
Ballots withheld from canvass:	
From members in arrears of dues	62
Without signature	11
Total number of ballots received	4,573

Respectfully submitted,
J. D. Parsons, *Chairman*
M. O. Elkow, *Vice-Chairman*

H. F. Hormann	Harold I. Thropp
W. H. Dieck	Thomas R. Kuesil
John J. Dwyer	H. C. Lamberton, Jr.
E. P. Albright	Sherman Glass
F. W. Hoak	Joseph C. Fegan
Richard T. Richards	E. M. Craig, Jr.
Harold Garb	Thomas K. A. Hendrik

* Died on August 19 (see page 57)
† Nominations withdrawn.
‡ These votes were cast for incumbent officers who are presently ineligible for reelection in accordance with Section 5, Article V of the Constitution.

Members Named Officers of Hydraulics Research Group

Dr. Lorenz G. Straub, M. ASCE, director of the St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minn., was elected president of the International Association for Hydraulic Structures Research at its recent triennium conference in Stockholm, Sweden. Other new officers, whose terms will become effective January 1, 1949, are: Prof. E. Meyer-Peter, Switzerland, first vice-president; A. N. Khosla, M. ASCE, India, second vice-president; and Prof. J. Th. Thijsse, Netherlands, secretary. Permanent committee members include, in addition to the officers, Dr. P. F. Danel, Assoc. M. ASCE, France, and Sir Claude Inglis, M. ASCE, England. Prof. B. M. Hellstrom, M. ASCE, Sweden, is a corresponding member.

The association selected Grenoble, France, for a meeting in August 1949, preceding the conferences of the International Congress of Navigation in Lisbon. The next triennium conference will be held in Delhi, India, in February 1951.

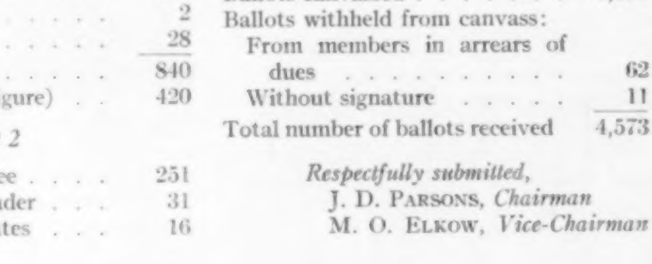
Official ASCE delegates to the conference were: J. B. Tiffany, Jr., chairman, Lorenz G. Straub, Boris A. Bakhmeteff, and A. E. Cummings.

Column Research Council Approved by ASCE Board

Upon recommendation of the ASCE Committee on Research, the Board of Direction at its Seattle meeting endorsed the request of Column Research Council to Engineering Foundation for an allotment from the Foundation for the fiscal year 1949. The Column Research Council is one of four Society-sponsored research projects currently being carried out by Engineering Foundation.

ASCE Members Meet on French Riviera

IMPROMPTU GET-TOGETHER of two Society members and their parties in Nice, France, is result of chance meeting while touring Europe. Francis S. Friel, consulting engineer of Philadelphia and former president of Philadelphia Section (shown at left with Mrs. Friel) has been attending Large Dams Conference in Stockholm and Soil Mechanics Conference in Rotterdam. ASCE Past-President J. P. Hogan, New York City consultant, is vacationing with his wife (center) and sister (right).



NOTES FROM THE *Capital*

E. Lawrence Chandler, M. ASCE
Assistant Secretary ASCE

THE BOARD OF Direction, at the Seattle Meeting, took several actions looking toward improving relations between engineers and federal agencies.

From time to time, Civil Service regulations have provoked protests from engineers in federal employ that the best interests of both the federal government and of engineering employees have not been served in numerous instances. With the belief that a committee of engineers, acting in a capacity advisory to the Civil Service Commission, could serve a useful purpose in connection with the formulation of policies and regulations pertaining to engineering employees, the Board directed that the matter be referred to Engineers Joint Council for exploration with the Commission and recommended that, if found practicable, such an advisory committee be established.

In the past, the Society has formally protested the classification of engineering firms as being engaged in Interstate Commerce under the terms of the Fair Labor Standards Act with the consequent liability of prosecution by the Wage and Hour Division of the Department of Labor for violations of law. A specific source of difficulty under existing regulations has been confusion about the classification of employees as "professional" or "nonprofessional," and the Society's views have been presented to the administration of the Wage and Hour Division. This whole matter is one of substantial importance and the Board of Direction instructed the Society's Committees on Employment Conditions and on Private Engineering Practice jointly to undertake a study of the entire situation.

The practice, on the part of federal agencies, of advertising for sealed bids for engineering services in connection with federal projects has caused frequent and strenuous objection from consulting engineering firms. The Board took formal action expressing disapproval of such practice and referred the matter separately to the Committee on Private Engineering Practice and to the Committee on Public Engineering Practice and Policy for investigation and recommendation as to appropriate action.

Society Is Represented at Applied Mechanics Congress

DR. MARIO G. SALVADORI, assistant professor of civil engineering at Columbia University, has been appointed to represent both the ASCE and Columbia University at the Seventh International Congress for Applied Mechanics, which will be held in London, September 5–12.

TENTATIVE REPORT (WITH APPENDIX) OF COMMITTEE ON COST ALLOCATION FOR MULTIPLE-PURPOSE WATER PROJECTS

On July 21, 1948, at Seattle, Wash., the Society's Committee on Cost Allocation for Multiple-Purpose Water Projects submitted a Tentative Report (with Appendix). An abbreviated description of the report appears in *Civil Engineering* for August, pages 18–19.

This Tentative Report is not to be printed in any Society publication. It is expected, however, that the final Report will be printed in the *Transactions*.

As to the Tentative Report and Appendix, the Committee will be receptive of comments and criticisms from the members. These will be fully considered in the preparation of the Committee's Report in final form, but probably will not be printed.

Mimeographed copies of both the Tentative Report (51 pages) and Appendix (69 pages) will be available to those members who are especially interested in the subject matter and particularly to those who contemplate preparing comments for the benefit of the Committee. Requests for copies should be made only if needed for these purposes and be in the hands of the Executive Secretary, American Society of Civil Engineers, 33 West 39th Street, New York 18, N.Y., by September 20, 1948.

Comments on the Tentative Report and Appendix should be submitted by November 15, 1948, addressed also to the Executive Secretary.

F. W. Scheidenhelm,
Chairman

Classification of ASCE Membership Is Tabulated

OCCUPATIONAL CLASSIFICATION OF the membership of ASCE, made on the basis of replies received in answer to the membership grades questionnaire sent out last year (see July 1947 issue, pages 64–68), can be considered representative of the entire Society membership. In response to the 18,000 questionnaires sent out, 9,400 were returned. That the replies were well distributed among the various grades of membership is indicated by the following tally:

Present membership grade in ASCE:

Junior	2,467
Associate Member	3,400
Member or Honorary Member	2,493
Affiliate	20
No Answer	39
Total	8,419

Inquiries as to occupational status and the results of that question are as follows:

Occupational status:

Owner or part owner of a business or a private or governmental supervisory employee responsible for all or any of the following:

Hiring, discharging, effectively recommending changes in pay rates, major changes in assignments, etc.	4,683
A non-supervisory employee	2,828
No Answer	908
Total	8,419

The occupational field is broken down as follows:

Major occupational field:

Private consulting practice in any capacity	1,716
Teaching or administrative member of a faculty	603
Contracting business in any capacity	1,097
Manufacturing business in any capacity	688
Public utility in any capacity	836
Other private business related to engineering	594
Private business not related to engineering	87

Employee of Government:

Federal	1,755
State	795
County	109
Municipal	537
Other public authority	150

Retired:	134
No Answer	164
Total	9,265

ASCE and AGC Cooperative Committee Is Established

ESTABLISHMENT OF A joint cooperative committee of the Society and the Associated General Contractors "to consider problems of mutual concern to engineers, contractors, and the public" was voted by the ASCE Board of Direction at its Seattle meeting. Organization of the committee will be along lines suggested at a preliminary conference in New York between Dwight W. Winkelman, president of AGC, and ASCE President R. E. Dougherty, with three members to be appointed from each society. The committee of six will meet or correspond as occasion demands.

It was mutually agreed that the authority of the committee as a whole or of either component of it is to be confined to study, review, and recommendation to their organizations, and that the joint committee shall not in any way supersede or interfere with the objectives or activities of existing ASCE or AGC committees.

President Dougherty has appointed Director Edmund A. Prentis as chairman of the ASCE group. A. N. Carter, Assoc. M. ASCE, Washington, D.C., will represent the AGC as co-secretary of the committee.

NEWS OF LOCAL SECTIONS

Scheduled ASCE Meetings

FALL MEETING
Boston, Mass., October 13–15
(Board of Direction meets October 11–12)

ANNUAL MEETING
New York, N.Y., January 19–21
(Board of Direction meets January 17–18)

SPRING MEETING
Oklahoma City, Okla., April 20–23
(Board of Direction meets April 18–19)

Coming Events

Central Ohio—Meeting at the Chittenden Hotel, Columbus, September 16, at 6:15 p.m.

Florida—Dinner meeting at the Hotel Seminole, Jacksonville, September 9, at 7 p.m.

Georgia—All-day meeting for inspection of construction of Clark Hill Dam, Augusta, September 11.

Indiana—Joint meeting with Kentucky and Cincinnati Sections, at the Clifty Inn, Madison, Ind., September 18 and 19.

Kansas City—Meeting of the Junior Activities Committee at the Liberal Arts Building, Kansas City University, Kansas City, September 20 and 21, at 7:45 p.m.

Louisiana—Meeting at the Louisiana State University, Baton Rouge, September 27, at 6 p.m.

Maryland—Meeting at the Engineers Club, Baltimore, October 13, at 8 p.m. Cocktails at 6, and dinner at 7.

Mid-South Section—Meeting at the University of Mississippi, University, Miss., to be held in conjunction with exhibition of construction equipment and machinery on college campus, October 7–9.

Pittsburgh—Social meeting, October 1, Edgewood Country Club, Pittsburgh. Golf in afternoon, dinner and entertainment in evening.

Wisconsin—Dinner meeting at the ESM Building, Milwaukee, September 20, at 6:30 p.m. Frank P. Zeidler, mayor of the City of Milwaukee, will be the guest speaker.

Recent Activities

BUFFALO

REGULAR MAINTENANCE DREDGING of the Black Rock Channel and Buffalo Outer Harbor was observed by members of the Buffalo Section and the Society of American Military Engineers on a recent joint inspection trip aboard the Army Corps of Engineers hopper dredges "Taylor" and "Hoffman." Almost 100 members of the two organizations witnessed the dredging operations and subsequent deposition of the sediment in the authorized dumping ground in Lake Erie. A buffet supper was served aboard the dredges. The Buffalo Section is planning to have a joint meeting with the Rochester, Ithaca, and Syracuse Sections at the Mt. Morris Dam site early in the fall.

ASCE BOOTH AT CHICAGO ROAD SHOW is manned by Juniors of Illinois Section. Booth, which was under auspices of Section, provided service to Society members and other prospective members. Many copies of "Civil Engineering," "Proceedings" and other ASCE publications, including manuals and pamphlets, were distributed. In view shown, William Berk, Illinois Section Junior, presents copy of "Civil Engineering" to South American engineer. Photograph furnished by Caterpillar Tractor Co.

BRIDGE CONSTRUCTION WORK IN PITTSBURGH AREA is objective of recent all-day inspection trip made by members of Pittsburgh Section. Schedule included new Elizabeth Bridge across Monongahela River and Edgewood Underpass of Pennsylvania Railroad under construction by John F. Casey Co., and Dravosburg and Rankin bridges across Monongahela being built by Dravo Corp. About 33 members made trip, which included noon luncheon meeting. Guides furnished by contractors explained projects.

CLEVELAND

A STUDY ON reinforced brick masonry was described in a paper read at a recent meeting of the Cleveland Section by Neil P. Atherton. The study—performed as a thesis at the Case Institute of Technology by Mr. Atherton, Frank Gerace, Andrew Milnar, and John de Hamel under the supervision of Prof. Leslie J. Reardon—consisted of (1) tests on the component materials of reinforced brick masonry and (2) tests on these materials integrated into test structures. As a result of the tests, the 60-day curing period for reinforced brick masonry, advocated in some building codes and specifications instead of the more usual 28-day period, was endorsed. It was also recommended that future studies of brick masonry incorporate an excessive amount of reinforcing steel in order to accentuate failure in diagonal tension.

PANAMA

DEVELOPMENT OF A coordinated sewage-disposal plan for Pacific terminal communities on the Isthmus of Panama was discussed at a recent meeting by Ernest W. Zelnick, hydraulic engineer for the Municipal Engineering Division of the Panama Canal. Mr. Zelnick served as Cana Zone representative in the development of the sewage disposal plan, working with the consultants, Greeley & Hansen, of Chicago.

SAN DIEGO

THE PROPOSED CONSTITUTIONAL amendments increasing Society dues were discussed at a recent meeting of the Section by ASCE Western Representative Walter E. Jessup, who gave an over-all picture of the Society's financial situation. A talk on the Reber Plan for the development of San Francisco Bay—presented by John M. Server, Jr., editor of *Western Construction News*—comprised the technical program. The plan, calling for construction of two dams across the bay and a fresh-water channel connecting them, would divide the bay into a northern section of fresh water from the Sacramento River; a central section of sea water; and a fresh-water southern section, fed from the northern section by the channel. Benefits of the project would include land reclamation (now infeasible because of salt infiltration); the possibility of developing additional industrial areas; an increase in the fresh-water supply; and the possibility of substituting the southerly dam for a second bay bridge.

SAN FRANCISCO

ASSEMBLYMAN THOMAS MALONEY, speaker pro-tem of the California State Assembly, addressed a recent meeting of the Junior Forum of the Section on the subject, "Inside Your State Government." A spirited discussion followed his talk. The Juniors will celebrate their 100th meeting on September 30 with an informal dinner dance at the Officers' Club of the San Francisco Naval Base on Treasure Island.

West Virginia Section Holds Dinner Meeting

DESIGN FEATURES OF the Bluestone Bridge were described at a recent dinner meeting, held at White Sulphur Springs, W.Va., by Frank D. McEnteer, consulting engineer of Clarksburg, W.Va. This project involves construction of a 1,500-ft span across the Bluestone Basin, near Hinton, W.Va., and piers rising 150 ft above the bottom of the basin. The many factors that had to be considered in the design resulted in the adoption of a cantilever-type superstructure with simple Warren-type trusses at each end. Col. R. H. Patterson was chairman of the committee in charge of arrangements for the meeting.

MEMBERS OF WEST VIRGINIA SECTION and their families attend recent dinner meeting at Greenbrier Hotel, White Sulphur Springs.

NEWS BRIEFS

Construction Activity for First Half of Year Shows 35 Percent Increase Over 1947

New construction activity and costs for the first half of 1948 show an increase in comparison with the first half of last year, according to a recent Department of Commerce Industry Report. The value of new construction put in place during this period reached almost $7.7 billion, an increase of 35 percent over the total for the first six months of 1947. Total new construction activity for the year 1948, as a whole, is expected to reach $18 billion. This figure, a joint estimate of the Department of Commerce and the Department of Labor, represents a 29 percent increase over the 1947 figure of $13,977 million.

Expansion of private residential construction, exclusive of farms, has been the principal factor in the increase. The value of private residential building put in place in the first half of 1948 amounted to $3.1 billion, nearly $1.2 billion (or 60 percent) above the total for the corresponding period of 1947. Private residential construction has accounted for 40 percent of all new construction so far this year.

Other principal items contributing to this increase in construction activity are: Public utility construction, up $280 million over the first six months of 1947; private commercial building (warehouses, office and loft buildings and stores, restaurants and garages), up $201 million; and public nonresidential building, up $184 million. Particularly large proportionate increases were shown by the various types of public nonresidential building, aside from industrial construction.

Construction of public education buildings in the first half of the current year totaled $218 million, an increase of 93 percent over the corresponding period in 1947. This increase is attributed to the lag in school construction during the war, the consequences of war and postwar population shifts, and the effect of federal assistance on veterans' education. Total expenditures for construction of all public and private educational buildings from January through June reached $315 million. Public hospital and institutional construction, influenced by expansion of construction operations on veterans' hospitals, increased 109 percent over the first half of last year. Other public nonresidential building rose 113 percent during the same period.

Although the dollar value of new construction activity reached a record high in the first half of 1948, the physical volume of construction still continues substantially below previous peaks. For the first five months of 1948 (the latest period for which cost indexes are available) total new construction measured by 1939 prices, an indication of change in physical volume, was 19 percent above the figure for the corresponding period in 1947. However, this construction total was about 20 percent below the five-month total for 1942, a year when physical volume was close to peak levels.

During the first half of 1948, construction costs continued to increase, though the increase was at a slower rate than during 1947. In May (the latest month for which cost indexes are available) the Department of Commerce Composite Index of Construction Costs, which undertakes to provide an average measure of changes in cost of construction of all types, was more than double the figure for the prewar year 1939. The index for May was 209.0 (base: 1939 = 100), some 4.1 percent higher than in December and 12.4 percent above May 1947.

State Highway Officials Map 1948 Safety Campaign

Active leadership in the nation's fight against highway accidents must be assumed by the states if the Action Program initiated by the President's Highway Safety Conference in 1946 is to maintain its force, according to the State Officials' National Highway Safety Committee. Pointing out that there will be no national safety conference this year, the committee states that full-scale and vigorous action on the part of state officials and public groups is more essential than ever. "The problem is not merely to hold the line, but to keep the traffic death rate declining despite increases in motor vehicle travel."

As an aid to the states in meeting these obligations, the Committee has prepared a program, entitled "A Job for the State in '48." The various "actions" emphasized in this agenda include: State-wide traffic safety conferences; city conferences; participation in national traffic safety contests; establishment of interim committees in each state to study uniform laws and prepare model ordinances; long-range planning studies to evaluate highway needs; liaison with the national committee; study of traffic-accident records; education; enforcement; sound driver-licensing administration and practice; utilization of trained personnel to give public information; and sound engineering.

Under the latter head, the committee lists a course of action for state highway departments. Recommendations include coordination of the state highway program with the work of local planning and civic groups, the police, and educators; planning surveys as a basis for long-range plans for road improvement; cooperation in the national traffic research program; revision of grade-crossing laws to conform with the Federal-Aid Highway Act of 1944; establishment of training courses within the highway departments; improvement of standards of design; acceptance of the access-control type of highway construction; and use of highway accident records.

Businessmen to Confer on Solution of Urban Problems

To aid community leaders in the application of city planning and traffic engineering techniques to their local areas, the Chamber of Commerce of the United States is sponsoring a second Businessmen's Conference on Urban Problems, to be held in Detroit, Mich., September 13 and 14. This meeting is based on the premise that businessmen should play a leading part in finding the solution to such municipal problems as traffic congestion, parking and trucking difficulties, and the spread of blighted areas.

General topics to be considered and the chairmen who will conduct the four sessions, are: "Planning the Development of the Smaller Community," Carl W. Hogg, vice-chairman, City Planning Commission, Salem, Ore.; "Parking and Trucking," Theodore M. Matson, director, Bureau of Highway Traffic, Yale University; "City Streets and Modern Transportation," Carl J. Rutland, chairman, Citizens' Traffic Commission, Dallas County, Dallas, Tex.; and "Planning and Redevelopment of the Larger Community," Willis H. Hall, chairman, Detroit City Planning Commission.

The conference will be sponsored by two units of the Chamber of Commerce—the Construction and Civic Development Department and the Transportation and Communication Department—with the assistance of the Detroit Board of Commerce. The first such conference, held last September in Washington, D.C., was attended by 550 persons from all parts of the country.

Wide Increase in Use of Stainless Steel Reported

Rapid increase in the use of stainless and heat-resisting steels is reported by the American Iron and Steel Institute. Attributing this increase to improvements in the product effected by extensive research in the field of metallurgy, the Institute contrasted the United States 1947 production of these steels, which totaled 520,000 tons of ingots, with the 1939 output of 180,000 tons of ingots.

Prizes to Be Awarded in Community Planning Contest

To ENCOURAGE THE building of better communities throughout the country, the Community Development and Shopping Center Committee of the National Association of Home Builders is sponsoring a nationwide contest. Three regional and three national awards will be given in each of the following five classes: Best small groups of single-family homes under 50 units with emphasis on economy housing; best single-family group over 50 units with emphasis on economy housing; best residential community; best garden apartment of multiple group; and best suburban shopping center where construction is 25 percent complete.

Participation is limited to members of the National Association of Home Builders. Additional details of the contest, which closes November 1, may be obtained from the NAHB, 1028 Connecticut Avenue, N.W., Washington, D.C., or from any of the local offices of the organization.

Major Contracts for Soo Power Plant Project Let

WITH THE AWARD of two main construction contracts, work on the 14,500-kw hydroelectric power plant at St. Marys Falls Canal, Sault Ste. Marie, Mich., will begin early in September, according to a recent Corps of Engineers announcement issued through the Detroit District office. Scheduled for completion in 1951, the project will provide additional power for Sault Ste. Marie and adjacent territory and continue to furnish power for operation of the government-controlled locks.

The Dunbar & Sullivan Dredging Co., of Detroit, was awarded the contract for excavation of the upper headrace and tailrace and construction of the rock-filled dikes and derrick-placed facing for the dikes. The major contract—for construction of the power plant, installation of equipment, construction of a crib dam, and miscellaneous work on dikes—went to the Tuller Construction Co. of Red Bank, N.J.

Makes Survey of Foreign Professional Regulations

LATIN AMERICAN REGULATIONS governing professional practice have been assembled and summarized by the National Council of State Boards of Engineering Examiners in a campaign to eliminate or minimize existing barriers to international practice. Engineers, whose work necessitates practicing in South or Central American countries, may obtain a list of these regulations from D. B. Steinman, M. ASCE, chairman of the National Council Committee on Registration by Endorsement, 117 Liberty Street, New York, N.Y.

Federal-Aid Airport Terminology Is Defined in "Out at Airport" Series

ASKED BY CONGRESS to develop precise definitions of the various terms involved in carrying out the Federal Airport Act, the Civil Aeronautics Administration has adopted a number of definitions. Some of this terminology is reported in a recent issue of *Out at the Airport*, publication of the Airport Division of the American Road Builders Association.

The publication indicates that the CAA lists construction alterations and repair of an airport as *Airport Development*, and that a *Program* is defined as lists of *public* airport projects at given locations, scheduled to be undertaken within the limits of currently available federal airport funds. It makes clear that before an airport project may be considered for inclusion in a program, a *Project Request* must be filed by a sponsor or duly authorized agent. Filing such a request does not necessarily assure inclusion of a project in a program, nor does it obligate the sponsor to "go through" with acceptance of an allocation of federal-aid funds, it is pointed out.

Other CAA definitions reported include a *Sponsor*, listed as one or more *public* agencies, which will control an airport to be developed under federal-aid. It is explained that a duly authorized agent, such as a state or one of its departments, might act as sponsor, for instance, for a municipality or county. *Sponsor's Assurances*, a term in the Act, are said to be "the crux and epitome of Government-Airport Sponsors relationships, and agreements on the part of each to accomplish specific things. Such assurances are given by sponsors of each federal-aid airport project for a 20-year period, or 'during the useful life of the facilities.'

"The *National Airport Plan* is a list of locations which makes up the over-all plan for a country-wide system of useful *public* airfields. The National Airport Plan is required by Congress, and is made up by CAA to cover the foreseeable aeronautical needs deemed most urgent during the next three-year period, and is subject to yearly revisions to reflect an up-to-date appraisal of airport needs to round out an integrated system to effectively serve the entire country."

A *Project Request* is defined as a sponsor's informal expression of interest or desire to participate in the Federal-aid Airport Program, and a *Project Application* as a sponsor's formal, detailed application for a grant of federal funds for airport development. "The Sponsor's Assurances are contained in Project Applications. Before a Project Application may be filed for a given project, the location of the project must be included in the current National Airport Plan."

The publication lists a *Tentative Allocation* as CAA's Administrator's notice of an allocation of federal-aid funds to a sponsor to develop agreed-upon phases of a *public* airport. An *Offer* is made by CAA, stating a definite amount the government will assume of the cost of an airport project. A *Grant Agreement* is defined as CAA's offer to have the government assume a share of an airport's cost, plus the airport sponsor's acceptance thereof. Acceptance of the Grant Agreement puts in effect the Sponsor's Assurances.

Irrigation Engineers Leave for Siam After Study in United States

ENGINEERS FROM SIAM, part of group of 30 from Royal Irrigation Department of Government of Siam who have been observing American methods and procedures under auspices of Bureau of Reclamation, leave New York by plane for return trip to Siam. Group has been studying reclamation projects in Western states during past year in preparation for building dams for irrigation of rice fields in Siam.

Hydroelectric Dam Is Flame Cleaned

PAINT IS REMOVED from hydroelectric dam at Reusens, Va., by oxyacetylene flame. In one operation intense heat cockles old paint, loosens rust, and removes surface moisture to prepare steel for repainting. Job was handled by Miller Contracting Co., of Ohio. Photograph furnished by Air Reduction Sales Co.

Increase in Treatment of Timber Is Reported

MORE THAN 4,192 million fbm of wood was treated by the wood-preserving industry in 1947, according to statistics prepared by the U.S. Forest Service in cooperation with the American Wood Preservers' Association. This estimate, based on data from 310 plants, represents an increase of 13 percent over the amount of material treated in 1946.

Except for shortages of creosote preservative early in 1947, the amount of timber treated in that year would have exceeded the record year, 1939, when 4.3 billion fbm was processed, according to G. P. McGough, president of the American Wood Preservers' Association. Mr. McGough stated that continued wartime shortage of chemicals is the only factor retarding still further expansion of the industry.

AAAS Plans Five-Day Centennial Celebration

"ONE WORLD OF SCIENCE" will be the theme of the five-day centenary of the American Association for the Advancement of Science, to be held in Washington, D.C., September 13 to 17. Following keynote addresses by President Truman and Dr. Harlow Shapley, retiring president of the association and director of the Harvard Observatory, at the opening session on Monday evening, members and registered guests will be invited to attend a "diplomatic reception in tribute to one world of science" in the Pan-American Union Building.

The morning programs, consisting of symposia on scientific and technical problems of present-day importance, will include a session on housing, with Douglas E. Parsons, M. ASCE, chief of the Division of Building Technology of the National Bureau of Standards, Washington, D.C., presiding. Other sessions of special interest to civil engineers include those on world health problems, scientific education, and problems of the ocean.

Founded in September 1848, "to promote intercourse between those who are cultivating science in different parts of the United States; to give a stronger and more general impulse, and more systematic direction to scientific research in our country; and to procure for the labors of scientific men increased facilities and wider usefulness," the organization has grown from a group of 461 members to the world's largest general scientific society, representing through its affiliated societies more than half a million scientists.

New Waste Disposal Program Planned for New York City

ELIMINATION OF New York City's present method of burying garbage and waste material in city landfills is the objective of a three-year program of waste disposal recently submitted to the city by Robert Moses, City Construction Coordinator.

The $44,000,000 disposal plan calls for construction of new plants and extension and improvement of existing incinerator facilities. Provision is also made for the integrated development of new park lands, costing $5,700,000, as part of the program. These recreational areas will be composed of waste materials, used as landfills during the three-year period of construction and expansion.

Positions Announced

Army Corps of Engineers, Alaska District. The District Engineer of the Alaska District will hold meetings in Seattle, Kansas City, Chicago, and New York to interview contractors interested in the construction program in Alaska, which will involve approximately $65,000,000 worth of work in the next year and a half. The District will furnish housing, messing, and all necessary equipment. Transportation from barracks to jobs will be furnished, and a large part of the materials necessary to start construction is available. The District Engineer would also like to interview persons interested in employment in the District Office in grades P-5 and under. Such persons should plan to attend the meetings. Salaries are at normal Civil Service rates, plus 25 percent.

Army Corps of Engineers, Portland District. Professional engineers, grades P-1 to P-4, are needed by the Portland District for its home office and field installations. Salaries range from $2,947.80 to $5,232. There are also vacancies in subprofessional grades for dredging operators, general construction inspectors, and civil, cartographic, and structural draftsmen, at salaries ranging from $2,974.80 to $3,351. Qualified personnel should get in touch with the District Engineer, 628 Pittock Block, Portland 5, Ore.

State of Minnesota. Applications for Public Health Engineers will be accepted for an indefinite period by the State of Minnesota Civil Service Department, with examinations held periodically. The salary range for Engineering Aides is $214–$254; for Engineer I, $290–$340; for Engineer II, $361–$421; for Engineer III, $436–$496; and for Engineer IV, $502–$572. Application blanks and information may be obtained from any local U.S. Employment Service office, or the Minnesota State Civil Service Department, 122 State Office Building, St. Paul 1, Minn.

Mock-Up of Crawler Tractor Draws Interest at Road Show

QUESTIONS ASKED BY PUBLIC about mock-up model of huge crawler tractor, exhibited at Chicago Road Show, are indicative of general acceptance of idea of unlimited size in road construction equipment. Model was reproduced so realistically in comparison with actual 18-ton international TD-24, that it took considerable effort for company officials to persuade public that model was only accurate wooden copy.

Bureau of Reclamation Announces Bid Calls on Western Projects

SEVERAL LARGE CONSTRUCTION projects, on which work is about to begin, are listed by the Bureau of Reclamation in its *Advance Construction Bulletin* for August 2, under the head of "Bid Calls Expected This Month." Although the bulletin states that the information given is not final, the data listed will afford an idea of the nature, size, and location of the proposed reclamation projects.

EARTHFILL DAM

Missouri Basin Project, South Dakota

Location: On the Grand River about 20 miles south of Lemmon, S.Dak.

Work: Construction of Shadehill Dam, an earthfill structure, approximately 118 ft high and 13,000 ft long.

Excavation for dam and spillways (all classes)	2,495,000 cu yd
Concrete	8,000 cu yd
Furnishing and placing reinforcing steel	1,100,000 lb
Earthfill	4,900,000 cu yd
Riprap	65,000 cu yd
Gravel fill	225,000 cu yd
Furnishing and handling cement	12,000 bbl

Time Allowed for Completion: 1,000 days

EARTHFILL DAM

Missouri Basin Project, Colorado-Kansas

Location: On the south fork of the Republican River near Hale, Colo.

Work: Construction of Bonny Dam, an earthfill structure, approximately 130 ft high and 9,300 ft long.

Excavation (common) for foundation of dam	650,000 cu yd
Excavation (all classes) for outlet works, spillway	1,260,000 cu yd
Excavation (common) and transportation to dam	10,500,000 cu yd
Earthfill in embankment	9,150,000 cu yd
Furnishing and placing riprap	215,000 cu yd
Furnishing and placing gravel blanket	95,000 cu yd
Concrete in spillway and outlet works	41,000 cu yd
Furnishing and handling cement	50,000 bbl
Furnishing and placing reinforcing steel	3,580,000 lb
Installing high pressure gates, valves, and controls	47,000 lb
Installing outlet pipe	400,000 lb
Installing miscellaneous metalwork	16,000 lb

Time Allowed for Completion: 1,400 days

EARTHFILL DAM

Missouri Basin Project, North Dakota

Location: On the Heart River at Dickinson, N.Dak.

Work: Construction of Dickinson Dam, an earthfill structure approximately 50 ft high and 2,275 ft long.

Excavation	600,000 cu yd
Earthfill	282,000 cu yd
Concrete	7,300 cu yd
Furnishing and placing reinforcing steel	672,000 lb
Furnishing and handling cement	10,450 bbl

Time Allowed for Completion: 800 days

SIPHON

Columbia Basin Project, Washington

Location: Near Soap Lake, Wash.

Work: Construction of Soap Lake siphon, a concrete and steel structure 12,900 ft long.

Bids are to be invited on alternate plans as follows:

Plan 1

Schedule (1) Reinforced concrete pipe.

Excavation	168,000 cu yd
Concrete	32,000 cu yd
Furnishing and placing reinforcing steel	10,300,000 lb

Schedule (2) Reinforced concrete pipe, plate-steel lined.

Excavation	310,000 cu yd
Concrete	43,200 cu yd
Furnishing and placing reinforcing steel	15,300,000 lb
Furnishing and installing plate-steel liner	6,000,000 lb

Plan 2

Schedule (3) Reinforceu concrete pipe.

Excavation	173,000 cu yd
Concrete	33,000 cu yd
Furnishing and placing reinforcing steel	10,800,000 lb

Schedule (4) Anchors and pedestals for plate-steel pipe.

Excavation	165,000 cu yd
Concrete	19,000 cu yd
Furnishing and placing reinforcing steel	900,000 lb

Schedule (5) Plate-steel pipe.

Furnishing and erecting 22.3-ft dia plate-steel pipe including supports	8,100 ft

Time Allowed for Completion: 950 days

CANAL TURNOUT STATIONS

Central Valley Project, California

Location: Between Fresno and Visalia, Calif.

Work: Construction of 21 turnout stations between Stations 1,980 and 3,740 of the Friant-Kern Canal.

Excavation	41,000 cu yd
Concrete	1,100 cu yd
Furnishing and placing reinforcing steel	13,300 lb
Installing gates and hoists	70,000 lb
Installing miscellaneous metalwork	57,000 lb
Furnishing and installing 30 by 42-in. railroad crossing pipe	2,500 ft

Time Allowed for Completion: 500 days

Western Reclamation Projects Given Largest Appropriation

WESTERN IRRIGATION AND power projects were voted the largest appropriation in history in the closing days of the 80th Congress, with the passage of appropriation bills for both 1948 and 1949. Bureau of Reclamation appropriations for the past ten years are summarized in the accompanying tabulation from the Congressional Record, which gives total budget requests, including supplemental and deficiency requests, as well as total appropriations and expenditures for each fiscal year.

Fiscal Year	Budget Estimates	Appropriations	Expenditures
1939	$ 45,229,600	$ 44,544,600	$ 79,329,428
1940	80,071,600	76,984,600	96,365,934
1941	80,454,600	73,194,600	85,596,484
1942	100,769,631	101,361,631	91,438,942
1943	96,328,650	89,727,270	69,287,440
1944	41,161,400	38,275,500	54,587,242
1945	30,108,200	24,155,200	50,376,076
1946	146,838,700	117,365,050	64,362,688
1947	168,849,755	116,346,843	134,289,536
1948	196,407,400	143,185,038	[1] 191,500,000
1949	284,902,650	245,566,139	......

[1] Estimated.

Notes: (1) *Power revenues prior to 1948 excluded.* (2) *Expenditures include permanent appropriations: other 2 columns do not.* (3) *Emergency funds (WPA) included in "Expenditure" figures up until fiscal year 1946.*

Members Address Meeting of Rocky Mountain Laboratory

VARIOUS ASPECTS OF hydraulics were discussed by a panel of researchers and field experts at the two-day annual meeting of the Rocky Mountain Hydraulic Laboratory, held recently at Allenspark, Colo. At the afternoon technical session, papers were presented by Warren DeLapp, Jun. ASCE, of the University of Colorado, on "Velocity Distribution in Air-Entrained Flow"; M. L. Albertson, Jun. ASCE, of Colorado Agricultural and Mechanical College, on "Model Studies for Bed Load Measurements"; Emory W. Lane, M. ASCE, hydraulics consultant for the Bureau of Reclamation, on "Sediment Engineering"; and E. J. Devroey, of the Royal Colonial Institute of Belgium, on "Problem of the Tanganyika."

The second day was devoted to inspection of nearby sections of the Big Thompson Transmountain Diversion Project, being built by the Bureau of Reclamation.

Engineers Are Exempt from New Canadian Labor Law

EXCLUSION OF ENGINEERS from the provisions of the new federal industrial relations legislation in Canada, entitled "An Act to Provide for the Investigation, Conciliation, and Settlement of Industrial Disputes," marks the first time that the federal government has recognized engineering as one of the professions. Specifically, the act states "'employee'...does not include a member of the medical, dental, architectural, engineering, or legal profession qualified to practice under the laws of a province and employed in that capacity."

Before legislation was inaugurated, recommendations for exemption of the profession from collective bargaining provisions were made by the Engineering Institute of Canada, after a detailed study of the situation, in response to a request from members of the Cabinet for an expression of opinion. Later, requests for exclusion reached the Department of Labor from all the provincial associations of professional engineers, and the Canadian Institute of Mining and Metallurgy, the Chemical Institute of Canada, and the Royal Architectural Institute of Canada.

In taking the stand that the best interests of the profession would be served by exclusion from collective bargaining, the Engineering Institute of Canada stated that it "stands ready at any time to discuss the welfare of individuals or groups and to take a part in securing alleviation from working conditions which are not just or wise."

Mechanical Engineers to Undertake Price Survey

A NATION-WIDE INDUSTRIAL survey of high prices, based on increased production and transportation costs, will be undertaken by the distribution committee of the American Society of Mechanical Engineers, according to a recent announcement by Fenton B. Turck, chairman of the committee and president of Turck, Hill & Co., New York City industrial engineering firm.

Pointing out that the Supreme Court's recent cement decision can influence the pricing policies of many American industrial organizations, Mr. Turck stated that this decision now calls for factory-priced products, or f.o.b. billing, and outlaws the cement industry's prevailing system of quoting qualified prices for products delivered to customers in widespread markets.

"In addition," he said, "our total distribution system is now faced with rapidly increasing transportation costs. Direct labor charges of railroad transportation have increased faster than the advancement of transportation efficiency. This added expense of distribution is not limited to the cement or steel industry. Sound, established producer-consumer trade relations and the markets of many small and large companies, developed by individual integrity and responsibilities, are at stake."

Effect of Increased Truck Loads on Highways Studied by Highway Research Board

WITH THE ULTIMATE aim of determining highway design and regulatory policies, the Highway Research Board is sponsoring a study of the cost per ton-mile of hauling truck loads of various sizes over both modern highways and those of substandard design. The present study is the first phase of a projected broad investigation of economic limits, which will take into account transportation needs and both hauling and highway costs.

Limitation of highway loads has long been a controversial subject, with trucking interests claiming that greater benefits would result from loads larger than are now legally permitted, and highway engineers maintaining that such increases in loading might be responsible for serious damage to the highways. It is expected that the series of studies, which are a part of the research program of the Board's Committee on Economics of Motor Vehicle Size and Weight, will produce factual data on the economics of truck operation and highway construction that may be applied to a solution of the problem.

Cooperating with the Highway Research Board in the first phase of the investigation are the Army, the Public Roads Administration, the American Association of State Highway Officials, the Society of Automotive Engineers, the Association of American Railroads, the Pennsylvania Department of Highways, the Pennsylvania Turnpike Commission, and eight other national and state organizations.

Port Authority Exhibit Is Featured at Air Exposition

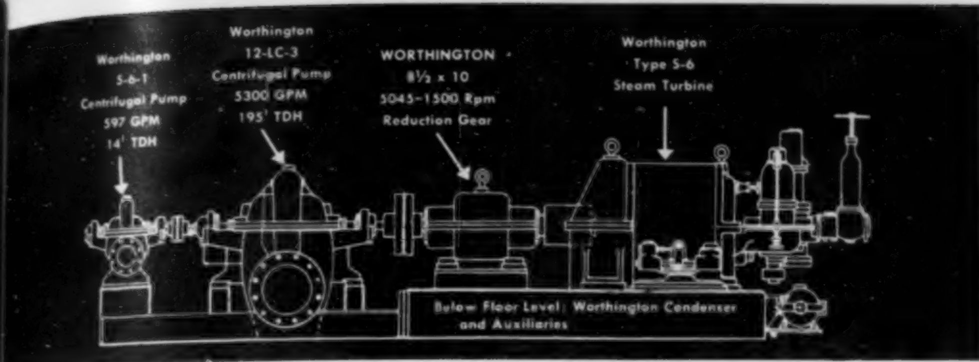
CONSTRUCTION DETAILS OF the New York International Airport, commercial activities of the Port of New York, and facilities operated in the metropolitan area by the Port of New York Authority were three main themes dramatized in a Port Authority exhibit at the recent Air Exposition at Idlewild, Queens. At the conclusion of the nine-day air show, the exhibit was moved to Grand Central Palace for the remaining months of New York City's Golden Jubilee celebration.

The tremendous investment in subsurface utilities, made by the City of New York preceding the above-ground development of the airport, is graphically illustrated in a display entitled "Forty Million Airport Dollars Go Underground." This exhibit consists of a "clamshell," the top of which depicts in scale a typical runway and taxiway intersection at the new airport. The top is animated, alternately opening and closing to reveal underneath the runway section, a transparent underground view of the airport showing in miniature the vital and costly utility installations. These utilities include nearly 60 miles of drain pipe, 24 miles of water mains and many miles of electrical conduits.

Other outstanding exhibits include a 16 × 18-ft "pit map," showing in exploded three-dimensional sections all the Port Authority facilities in the Port District. The theme of commerce in the area is dramatized by a large diorama view of New York Harbor which depicts motor trucks, planes, cars, and railroads entering the Port District.

Large Feed Mill Features Modern Design

TWO-MILLION-DOLLAR CONCRETE STRUCTURE recently completed at Fort Worth, Tex., represents "last word" in feed mill design. Materials totaling 30,000 bbl of cement, over 40,000 tons of sand and gravel and 1,400 tons of steel have gone into huge plant built for Burrus Feed Mills. Building, reaching 196 ft high, with over-all length of 295 ft, uses newest time- and labor-saving methods and machinery. New finished feed warehouse and carloading space adjoining mill building occupy $7^1/_2$ acres—all under single roof. Facilities provide for simultaneous loading of 32 box cars and eight large trucks. Structure requiring 750,000 man-hours to complete is design of Milling Engineers, Inc., Kansas City, Mo.



Side elevation of Worthington installation at Lorain, Ohio, water works

NEWS

FROM THE PUBLIC WORKS FRONT

AS REPORTED BY THE DEVELOPMENT ENGINEERS, FIELD SERVICE REPRESENTATIVES AND CUSTOMERS OF WORTHINGTON

A Lot of Water Has Gone Through This Pump

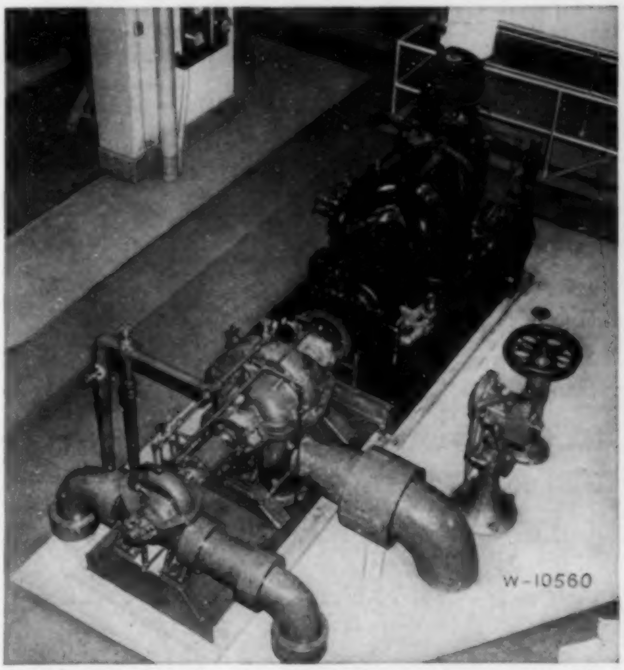
ore than ten years ago, the city f Lorain, Ohio (a community of 5,000 people) installed a Worthngton centrifugal pumping unit to eliver seven and one half million allons of water per day.

H. B. Wallace, chief engineer of he water works, reported recently hat this Worthington pump has perated continuously ever since ith never a shutdown except for outine maintenance.

During the majority of the time he pump has handled the entire apacity load; and at various times t has been required to handle apreciable overloads.

The complete water works unit onsists of a 7.5 mgd 12 in. pump hat is driven by a geared steam urbine with the main pump shaft ouble extended for connection to he condenser circulating pump; lso a surface condenser with its uxiliaries.

All elements are of Worthington anufacture, thus giving undivided esponsibility for proper operation.



Worthington Centrifugal Pump in water works at Lorain, Ohio

Springfield, Minn. Purchases Third Worthington Turbine Generator Unit

he city of Springfield, Minnesota, has for a ong time operated its own electric power lant.

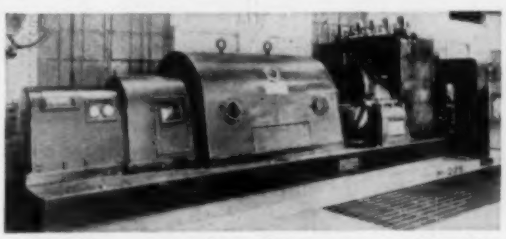
In 1895, electric power was furnished in a imited way from 5 to 10:30 P.M. each day by 40 kw generator driven by gasoline engine. n 1902 a steam engine with 50 kw belted enerator was installed. In 1915 this was relaced by a 100 kw steam engine, and the ystem was converted from direct current to lternating. At the same time a heating system or the business district was installed, using he exhaust steam which would otherwise be ost to atmosphere.

Further expansion came in 1923 with a 250 w steam engine. By 1937 the electric load ad so far outstripped the heating load that it ecame necessary to exercise economy in order to reduce cost of operation. A 750 kw oore automatic bleeder condensing turbine as installed; it was designed for 400 lb steam ressure, 670 F temperature.

Then the necessity for adapting all the modern practices of steam plants—including higher pressure and temperature—led to the purchase of a 1000 kw Moore automatic bleeder condensing turbine.

Acquisition of REA power contracts necessitated further expansion of the facilities. Last year a 2000 kw Worthington automatic extraction unit was put into operation along with a new high pressure boiler.

The plant now realizes maximum efficiency from the advantages of modern design.



Worthington 2000 kw turbine generator, City of Springfield, Minnesota

RTHINGTON PUMP AND MACHINERY CORPORATION, HARRISON, N. J.

NEWS from the public works front

Blue Brute Truck Mixers Take Peak Loads in Stride

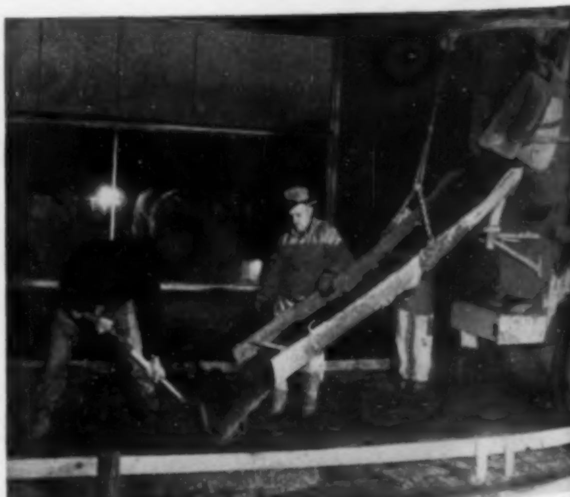
They're building in the Northwest these days, and one of the most enterprising among the builders is the Hitz Construction Company of Billings, Montana.

This company, in order to speed service and maintain quality, operates a fleet of nine Blue Brute Truck Mixers to furnish ready-mix concrete continually even under peak-load conditions.

The first Blue Brute mixer put to work by this company was a Worthington-Ransome Blue Brute 56-S Big Building Mixer, followed by two Blue Brute Hi-Up truck mixers. These mixers gave such fine service that the Hitz company steadily increased its Blue Brute equipment to a fleet of nine within one year.

At the present time, the Hitz Construction Company's Blue Brutes are completing a large unloading dock for the Northern Pacific Railroad—a contract which involves several thousands of cubic yards of concrete. The Blue Brute fleet has begun pouring concrete for the Carter Oil Company in connection with its $30,000,000 refinery program scheduled to be under full construction early in 1948. Equipped with an efficient plant, Hitz is prepared to furnish quality concrete to all the hundreds of large and small industries now under construction or being planned for Billings, Montana.

Mr. Hitz writes: "The Hitz Construction Company is building its business on service and quality of materials. The Blue Brute Hi-Up truck mixers, mounted on tandem-axle trucks, are a large factor in giving this service as they can get into spots and deliver concrete to those hard-to-get-at forms where no other mixers could do the job." Incidentally, Blue Brute "blue" was selected as equipment colors—a feature which has caused one contractor to remark that "they are the finest looking truck mixers in town."



Photos show Blue Brutes at work for Hitz Construction Company on large railroad dock for Northern Pacific Railroad

Sewage Gas Engine Returns $199,000

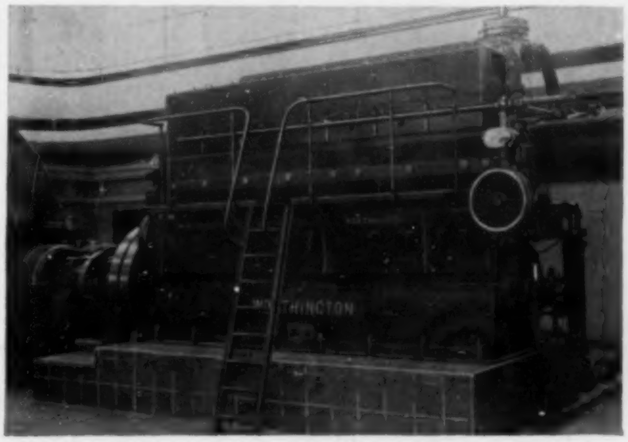
The annual report of the Fort Wayne (Indiana) sewage treatment plant reveals a 1946 saving of $38,000 by the 465 hp Worthington gas engine installation. This brings the total six-year saving to $199,000.

This plant, considered one of the outstanding municipal developments in the country and a focal point for inspection tours by engineers from other communities, was completed in 1940. Fort Wayne had been mandated by the Indiana State Board of Health to cease pollution of the Maumee River, and now the treated sewage is so free of offensive material that the river is capable of sustaining fish life.

Total sewage treated in 1946 amounted to 6,648,960,000 gallons—an average of 18.73 million a day. From this 7,000 tons of sludge was removed, and into it 5,345,890,000 cubic feet of air was pumped.

The Worthington gas engine was originally purchased at a cost of $30,000. The estimated saving is based on what it would have cost otherwise for additional electric power.

The engine contributes to heating the sludge digesters. The sludge is pumped in liquid form into four covered digesters where it is decomposed by bacteriological action, producing methane gas. Heat from the circulating water in the engine is used to raise the temperature of the sludge to the desired point for proper bacteriological digestion. In 1946, nine billion BTU's of heat went from the engine to the digesters—equivalent to 650 tons of coal.



Worthington Sewage Gas Engine—Fort Wayne, Indiana, Sewage Treatment Plant

New Diggers Join Blue Brute Line

Two new hard-hitting, light-weight air tools are announced as additions to the Worthington Blue Brute line of construction equipment. They are the Blue Brute W-14 Clay Digger and the W-114 Trench Digger.

New Blue Brute W-14 Clay Digger

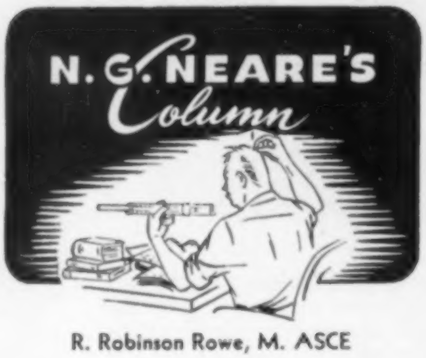
Both machines were developed in the field by owners and operators, and were proved in action by them on their own jobs before being released to the trade. They are consequently designed specifically for easy operation and convenience, and their many refinements of design permit considerably more hours of actual working time.

A typical example of the engineering technique incorporated into the W-14 and W-114 is a built-in lubricator to add long life and prevent unnecessary work interruptions. Both machines have an air inlet swivel, which allows the operator to swing the hose in any direction without tangling or kinking. Replaceable bronze cylinder bushing reduces maintenance costs and increases life of cylinder. The exhaust is directed away from the operator, improving his comfort and efficiency.

These new tools contain an entirely different, patented, double-metering tubular valve of Worthington design and construction. This revolutionary valve gives positive action, unaffected by valve wear, and assures low air consumption through accurate air measurement.

New Blue Brute W-114 Trench Digger

The W-14 Clay Digger is 19⅝ in. long, and weighs only 21 lb, without spade. The W-114 Trench Digger is 29⅝ in. long and weighs 29½ lb, without spade.



R. Robinson Rowe, M. ASCE

When the Tunnel Division of the Engineers Club was called to order at Seattle, the first item on the agenda was the Seattle-Seoul Tunnel. "Our specific problem is very clear," said the Chairman. "If a frictionless subway train would fall diametrically thru the earth in 2,530 sec, how long must it take to fall thru a tunnel from Seattle to Seoul, one-fifth the way around the earth?"

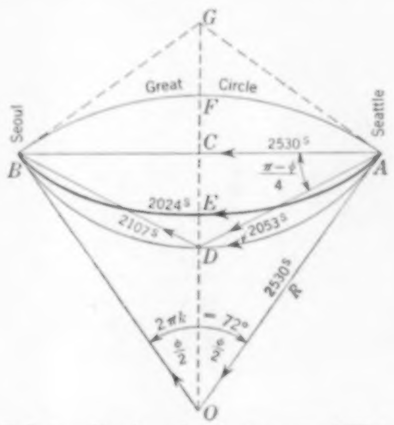


FIG. 1. The hypobrachystocrone AEB is quickest.

"We settled that just six years ago," replied Joe Kerr with more than a trace of sarcasm. "The time along any chord is the same as along a diameter, so the answer is 2,530 sec."

"Unless a longer tunnel would be quicker," countered Ken Bridgewater. "Notice that the Professor asked how long it *must* take. Obviously it would also take 2,530 sec along two radii AOB if the train could turn the corner at the center, so I looked for a quicker dogleg in between. The quickest, ADB, bisects the angle between chord and radius and would take 2,107.004 sec. If the subtended arc is $\phi = 2\pi k$, the general solution is $T = 2{,}530 \cdot \frac{2}{\pi} \cos^{-1} \tan^2 \frac{\pi - \phi}{4}$."

"You've guessed my idea, Ken," said Professor Neare, "but do you recall the line from Browning, 'It's a long lane that knows no turnings'?"

"I'm way ahead of you, Noah. I investigated the circular arc ADB normal to the earth at Seattle and Seoul and found that it went thru the vertex of the quickest dogleg, which seemed very propitious. Sure enuf, the time by this route is only 2,053.170 sec. The general solution, involving the complete elliptic integral K, is $2{,}530 \cdot \frac{2}{\pi} \sin^{1/2} \frac{\phi}{2} \cdot K\left(\sin \frac{\pi - \phi}{4}\right)$."

"I found a quicker curve," said Cal Klater. "Since the brachystocrone at the earth's surface is the cycloid and the cycloid is the special form of a hypocycloid for a directrix of infinite radius, I tried a tunnel along a hypocycloidal path AEB and found $T = 2{,}024$ exactly. The general solution is $T = 2{,}530\sqrt{4k(1-k)}$ and here $k = 0.2$ and $T = 2{,}530 \cdot 0.8 = 2{,}024$."

"Your analogic hunch is good, Cal. The quickest route can be found by the calculus ot variations, which leads to the polar differential equation

$$rR\sqrt{r^2 - M^2}\,d\theta = M\sqrt{R^2 - r^2}\,dr$$

in which M is a constant that turns out to be $R(1 - 2k)$, the distance from center to sump of tunnel. It's a nice exercise to prove that this equation fits the hypocycloid, because it is usually expressed in terms of a parameter.

"Our new problem concerns Tom, Dick and Harry, who often sipped at the bar as they shook to see who would pay for the next round. By their custom, each threw the five dice in turn, aces were counted cumulatively, and he who threw the 13th had to gild the bar. Chance sometimes made a long time between drinks, so Dick, who was not running for President, proposed to make the fifth ace the Jonah. When Tom and Harry protested that the odds wouldn't be nearly as even as before, Dick offered to roll first, second or third as they dictated. Which should it be?"

[*Lacking a real Cal Klater, the palm goes to John L. (Stoop) Nagle who derived Ken Bridgewater's solutions. The various routes are shown in Fig. 1*]

New Educational Film on Construction Available

Heavy rock excavation on four construction projects is featured in a 16-mm technicolor sound film recently released by the Gardner-Denver Co. of Quincy, Ill. Entitled "Man Against Rock," the film is a dramatic portrayal of rock drilling, blasting, mucking, and other phases of construction work. Projects depicted include grade preparation for the new location of U.S. Highway 40 in Colorado; construction of the South Dam of the Grand Coulee Project and appurtenant canals and tunnels; construction of the Continental Divide Tunnel near Estes Park, Colo.; and building of the Electra Tunnel near Jackson, Calif., for the Pacific Gas and Electric Co.

Prints of this film are available for showing to schools, engineering societies, and other interested organizations. Inquiries should be addressed to the Advertising Department of the Gardner-Denver Co., Quincy, Ill.

Wool Gatherings by WOOLLEY

Arizona's Supreme Court has voided a state statute permitting condemnation of utilities by municipalities on grounds the law allowed seizure of private property without just compensation.

There are 9 million American homes without running water, 29 million without water heaters and 3 million farms without electricity.

The electron microscope magnifies bacteria more than 100 diameters.

The radiation laboratory on the University of California campus at Berkeley is to have a 110-ft cyclotron, seventeen times as powerful as the present 184-in. model.

Nevada's Colorado River Commission hopes to act as a contracting agent in buying Shasta Dam power for distribution in the western and northern parts of the state.

The Engineering Institute of Canada recommended to a Parliament committee that engineers be excluded from a new national labor code in the same manner as are other learned professions. [See item page 66.]

The hydroelectric laboratory of the St. Paul district Corps of Engineers has been moved to the University of Minnesota from the University of Iowa where it has been for 19 years.

A survey of 117 engineering graduates of the college of engineering and architecture at the University of Nebraska showed that 65 of them are engaged in farming, banking, insurance and manufacturing.

The Bureau of Yards and Docks is establishing a new naval civil engineering laboratory at Solomons, Md., for basic and applied research in engineering problems and the development of amphibious equipment.

Coal consumption by electric utility power plants was 7,248,114 tons in April 1948—the highest April coal use of record.

Water power plants of electric utilities produced nearly 8 billion kwhr in April 1948—the highest monthly water power output of record.

More than half the water in the Colorado River at present flows through Mexico into the Gulf of California.

The first highway arch bridge in the world to be constructed of aluminum is now under way at Arvida, Quebec.

On the basis of loss of life and property damage, the flood in the Columbia River Basin is doubtless the most disastrous in the history of the basin.

Editor's Note: This column of "Wool Gatherings" is printed posthumously, as Ralf R. Woolley died on July 1. His obituary appears on page 80 of this issue.

NEW IN *Education*

Lehigh University to Study Welded Continuous Frames

Intensified research in welded continuous frames constitutes a five-year project to be undertaken at the Fritz Engineering Laboratory of Lehigh University. The new program, entitled "Ultimate Strength of Welded Continuous Frames," aims (1) to determine the basic behavior of beams, columns, and welded frames, and (2) to develop design procedures for continuous frames applicable to building and bridge construction.

The study, which will be conducted at an estimated cost of $13,000 per year, is being sponsored by the Welding Research Council, the American Institute of Steel Construction, and the U.S. Navy Office of Naval Research. The Column Research Council is also cooperating in a consulting capacity.

An outgrowth and intensification of previous Fritz Engineering Laboratory testing programs, the new project will be under the direction of Bruce G. Johnston, M. ASCE, director of the Laboratory. Lynn Beedle, Jun. ASCE, will serve as research engineer for the study.

A school for water plant operators and superintendents will be conducted at Pennsylvania State College, State College, Pa., October 25 to 29. The course, which is under the direction of the Sanitary Engineering Division of the college, is being sponsored by the Pennsylvania Water Works Operators' Association and the Pennsylvania State Department of Health.

University of Illinois Establishes New Machine and Foundry Laboratories

To give civil and mechanical engineering students a wide knowledge of the various methods of metal fabrication, the University of Illinois has established machine and foundry laboratories at its Undergraduate Division at Navy Pier, Chicago. Equipped with more than a quarter of a million dollars worth of machinery purchased from the War Assets Administration, the foundry department consists of three main sections—a sand laboratory, a coreroom and foundry, and a pattern design room—totaling 5,000 sq ft.

The sand laboratory has complete sand-testing machinery, including equipment for making sinter, permeability, strength, fineness, and moisture tests. A concrete laboratory, with testing devices capable of exerting pressures up to 300,000 lb, is another facility of the university at Navy Pier.

In the foundry and pattern course the students are divided into two groups, one taking foundry laboratory and the other pattern design. When the semester is half over, the groups are interchanged. The objective of this course is to give the student an understanding of: (1) The processes, materials, and products of the foundry as an example of fabrication, producing engineering parts for use in industry; (2) the advantage to the engineer designer of knowing the effect of design on the properties of the part produced by this method of fabrication; (3) the need for and use of methods of engineering control in obtaining the best possible properties at the least cost in casting; and (4) the types of casting and their properties produced by ferrous and nonferrous classes of metallic alloys and their engineering fields of application.

One of the first schools to take the actual production of molten metals out of the blueprint stage into the laboratory, the Navy Pier Division has melting equipment that includes a three-phase electric arc furnace of 250- to 300-lb capacity per hour for melting iron and steel, and a No. 30 crucible gas-fired stationary furnace for melting aluminum and bronze. The work is supervised by Prof. Joseph S. Kozacka, head of the engineering laboratories.

NEW MACHINE AND FOUNDRY LABORATORIES at University of Illinois Undergraduate Division at Navy Pier, Chicago, include facilities for production of molten metal in electric furnace.

Meetings and Conferences

American Society of Mechanical Engineers. Hydroelectric power resources and wood industries of the Pacific Northwest will be featured at the fall meeting of the American Society of Mechanical Engineers at Portland, Ore., September 7–10.

American Society of Tool Engineers. Newest developments in tools and machines and their utilization in the expanding West Coast industrial picture will be studied at the semiannual meeting of the American Tool Engineers, which is to be held at the Biltmore Hotel, Los Angeles, Calif., October 11–13.

Association of Iron and Steel Engineers. The forthcoming iron and steel exposition and convention of the Association of Iron and Steel Engineers, to be held in the Cleveland Public Auditorium, September 28 through October 1, will afford one of the most informative displays in the history of the iron and steel industry. The display will include technical advances and improved equipment since the war.

International Association for Bridge and Structural Engineering. The third congress of the International Association for Bridge and Structural Engineering is to be held in Liege, Belgium, September 13–18. A number of papers will be presented in each of the five technical sessions of the Liege congress program.

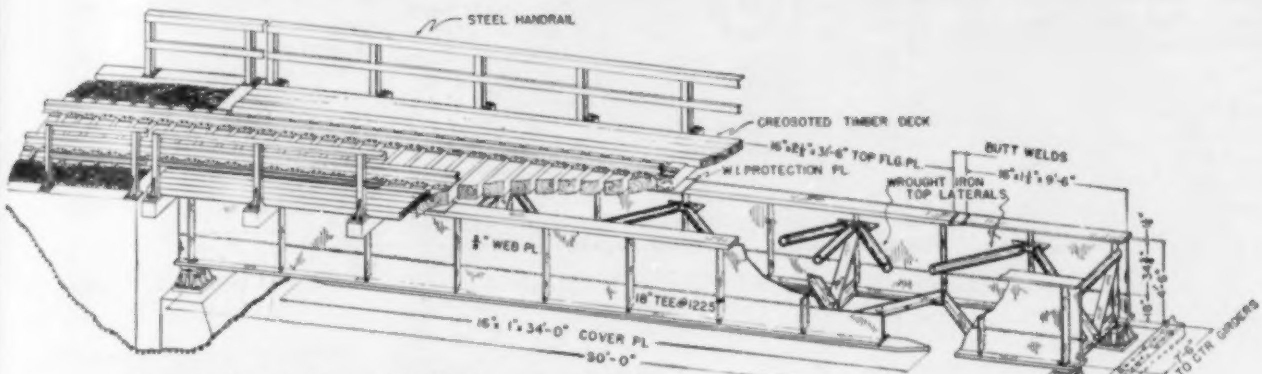
Third National Instrument Conference and Exhibit. New and recently developed products of the different instrument manufacturers will be displayed at the Third National Instrument Conference and Exhibit, to be held in Convention Hall, Philadelphia, Pa., September 13–17.

New Publications

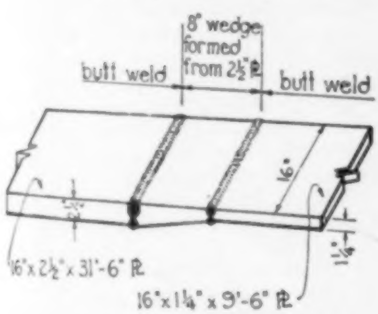
Analysis of Design. Basic principles for the guidance of designers and draftsmen in determining appropriate sizes, tolerances, and allowances for any design intended for interchangeable production, and methods of applying these principles to the solution of various types of dimensional problems, are outlined in a 123-page publication of the British Ministry of Supply, entitled *Dimensional Analysis of Engineering Design*. Copies of this publication, issued as Part I of a projected three-part series, are on sale at the British Information Services, 30 Rockefeller Plaza, New York 20, N. Y., at a cost of $2.35.

Water Resources. Silting surveys of 27 Ohio reservoirs, made by various government, state, and local agencies, are summarized in *Sedimentation of Reservoirs in Ohio*, by Earl E. Sanderson. Issued as Bulletin No. 17 of the Ohio Water Resources Board, this publication continues the survey of ground-water resources of the state being made by the Board in cooperation with the Water Resources Branch of the U.S. Geological Survey. Inquiries should be ad-

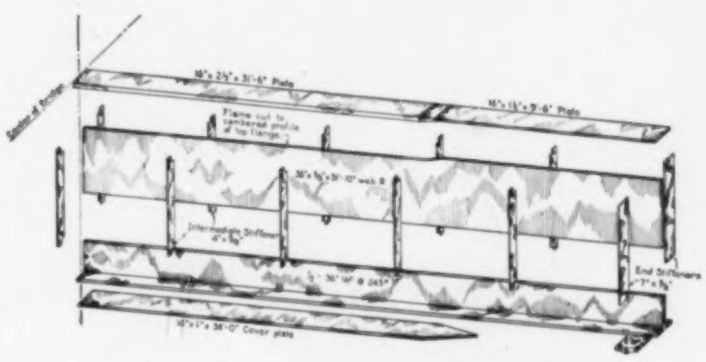
How to build an open deck railroad girder bridge



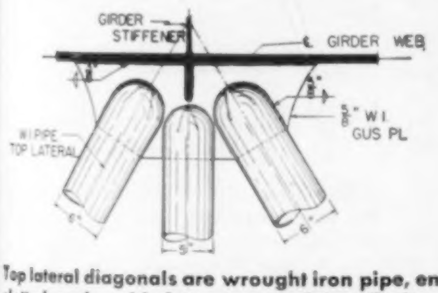
Railroad girder bridge with 50 ft. span, all-welded construction, designed for Cooper's E-72 loading. Entire superstructure can be assembled and welded in shop for shipment to site, minimizing interruption of traffic.



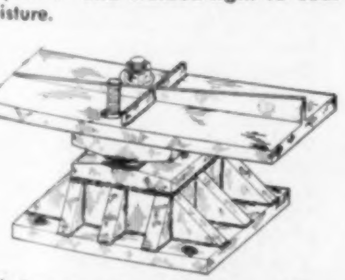
Tapered section inserted near ends of top flange for smooth transition of stresses.



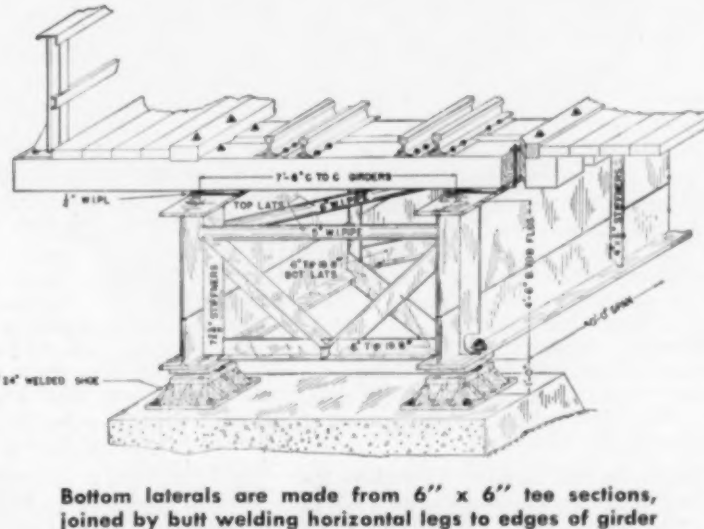
Bottom flanges are made from half of 36" WF 245 lb. beam, web split down middle, flange reinforced with 16" x 1" plate as shown.



Top lateral diagonals are wrought iron pipe, ends slotted and welded to gusset plates. Ends are "orange peeled" and welded tight to seal them from moisture.



Pedestal shoe consists of series of flame-cut crossed web plates. Bearing surfaces are made from weld deposit of chrome nickel steel.



Bottom laterals are made from 6" x 6" tee sections, joined by butt welding horizontal legs to edges of girder flange and fillet welding vertical legs to girder web. This view shows end of span.

The above is published by LINCOLN ELECTRIC in the interests of progress.
Complete details on this bridge are given in a current series of Structural Studies Plates. Free to structural engineers. Write on your letterhead to The Lincoln Electric Company, Dept. 155, Cleveland 1, Ohio.

dressed to the Ohio Water Resources Board at Columbus, Ohio.

Recreational Development, Michigan. Progress made to date in the construction and development program of the Huron-Clinton Metropolitan Authority—established in 1942 to develop the recreational opportunities of the Huron and Clinton river valleys and to aid in the development of the Detroit riverfront—is described in the Third Biennial Report of the Board of Commissioners of the Authority. Inquiries should be addressed to the Huron-Clinton Metropolitan Authority, 1100 Cadillac Square Building, Detroit 26, Mich.

Port and Terminal Charges. The Army Board of Engineers for Rivers and Harbors announces publication of the 1948 edition of Miscellaneous Series No. 1, *Port and Terminal Charges at United States Seaports.* Copies of this report may be purchased for $1.25 each, from the Superintendent of Documents, Government Printing Office, Washington 25, D.C.

Purdue University Bulletins. Recent publications of the Purdue University Engineering Extension Department include *Proceedings at the Thirty-Third Annual Road School,* issued as Extension Series No 63; *Proceedings of the Third Industrial Waste Conference,* Extension Series No. 64; and *Research Activities for the Sessions of 1946–1947,* Research Series No. 102. These bulletins may be obtained without charge from the Engineering Experiment Station, Purdue University, Lafayette, Ind.

Steel Structures Research. Tests of 47 riveted beam-to-column connections, made in the Fritz Engineering Laboratory of Lehigh University, are interpreted in Progress Report No. 1 of the Committee on Steel Structures Research of the American Institute of Steel Construction, entitled *Riveted Semi-Rigid Beam-to-Column Building Connections.* Authors of this 118-page report are Robert A. Hechtman, Jun. ASCE, research engineer at the University of Illinois, and Bruce G. Johnston, M. ASCE, professor of civil engineering and director of the Fritz Engineering Laboratory at Lehigh University. Free copies may be obtained from the American Institute of Steel Construction, 101 Park Avenue, New York, N.Y.

Highway Studies. Data on Kentucky highways, collected by a Citizens Committee for Long Range Highway Planning, have been assembled and interpreted in a report to the Commissioner of Highways of Kentucky, under the title *The Facts About Highways.* Inquiries concerning this report, which presents for the first time the magnitude of the road situation in the state, should be addressed to the Commissioner of Highways, Frankfort, Ky.

Public Health. Results of a nation-wide survey to determine the sanitation needs of the country—made by the Sanitary Engineering Division of the Public Health Service in 1947—are now available as Supplement 204 to the Public Health Reports. Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D.C., at a cost of 15 cents each. Another recent Public Health Service bulletin, *The Annual Combined Report and Plan,* discusses variations in the public health programs of the different State Health Departments.

Metallurgical Research. More than 600 engineering and production specialists have contributed to the 1948 edition of the *Metals Handbook.* Divided into four principal sections (General, Ferrous Metals, Nonferrous Metals, and Constitution of Alloys), the volume covers the results of extensive wartime research that, for security reasons, have not been printed before. Copies may be purchased for $15 from the American Society for Metals, 7301 Euclid Avenue, Cleveland 3, Ohio.

Home Building. What prospective home builders should know about business dealings with architects and contractors is told by the University of Illinois in a circular issued by the Small Homes Council. The present release, twentieth in a series of circulars on various phases of home planning and construction, may be obtained free from the Small Homes Council, University of Illinois, Urbana, Ill.

Highway Research. To aid highway engineers in studying the destructive effects of frost action on soils, the Committee on Frost Heave and Frost Action in Soils of the Highway Research Board has compiled a selected and annotated bibliography on the subject. Issued as Bibliography No. 3, this publication may be obtained from the Highway Research Board, 2101 Constitution Avenue, Washington 25, D.C. A Highway Research Board symposium on polarized headlights, as a solution to the hazard of glare, is reported in Bulletin No. 11, which may be obtained from the Board.

Airport Pavement Design. Recent developments in the use of welded wire fabric reinforcement in airport pavement design are summarized in a 32-page *Design Manual for Airport Pavements,* prepared by the Wire Reinforcement Institute, Inc., under the technical supervision of Theodore J. Kauer, M. ASCE, managing director. A practical handbook for the engineer in the design of airport landing facilities conforming to CAA requirements for projects planned under the Federal-Aid Airport Act, this publication may be obtained without charge from the Wire Reinforcement Institute, Inc., 1049 National Press Building, Washington 4, D.C.

Town Planning. The American Technion Society (154 Nassau Street, New York 7, N.Y.) has made available in reprint form an article from the *Technion Yearbook* for 1947, entitled "Man and Town," by Alexander Klein. This article describes plans for the construction of a projected city to be built on the coastal plain of Palestine between Tel-Aviv and Haifa.

Traffic Agencies and the Law. To acquaint those charged with traffic management with the sort of acts or omissions in the field that have resulted in damage suits, and with the type of court decisions that have been handed down, the Eno Foundation for Highway Traffic Control has made an analysis of selected cases in a 64-page pamphlet, entitled *The Legal Responsibilities of Traffic Agencies.* Copies may be obtained without charge from the Institute, Saugatuck, Conn.

German Roads. The condition of the German highway system, as it appeared to a group of British highway engineers who made an inspection tour of the famous national network of roads in 1946, is reported in Road Research Technical Paper No. 8, a recent publication of the British Department of Scientific and Industrial Research. Copies may be purchased from the British Information Services, 30 Rockefeller Plaza, New York 20, N.Y., at 55 cents each.

History of Navy's Wartime Construction Program Issued

THE FAR-FLUNG ACTIVITIES of the Navy Bureau of Yards and Docks from 1940 to 1946 have been compiled in an exhaustive two-volume history, entitled *Building the Navy's Bases in World War II.* Since the Bureau's war program antedated the declaration of war, the publication includes a record of the prewar status of Navy shore establishments as well as the story of wartime construction accomplishments. Although essentially a record of the work of the Bureau of Yards and Docks, its construction battalions and the many engineering and contracting firms associated with it in its war program, the report attempts to correlate these activities with the broad sequence of events and with the policies and decisions that determined the Navy construction program.

Both volumes are for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Volume I (447 pages) is priced at $3.25, and Volume II (522 pages) at $3.75.

TVA Announces Publication of New Technical Reports

ISSUANCE OF TWO new technical reports has been announced by the Tennessee Valley Authority—Volume 2 of Technical Report No. 5, *The Hiwassee Valley Projects,* and Technical Report No. 21, *Concrete Production and Control.* The 787-page volume on the Hiwassee development covers the planning, design, construction, costs, and initial operations of the Apalachia, Ocoee No. 3, Nottely, and Chatuge projects. Included in the appendixes are a complete statistical summary of the physical features of the projects; reports of engineering and geologic consultants; and descriptions of special studies, such as hydraulic model investigations. Bibliographies on each phase of the project are also given.

A record of the more important facts concerning concrete production and control achieved in the construction of the major water-control structures of the Tennessee River system is given in Technical Report No. 2, a 352-page publication on concrete.

Since only a limited number of these reports is available at present, they are not for sale. However, copies may be reviewed in leading libraries throughout the country.

NEWS OF Engineers

Nephi Albert Christensen, dean of engineering at Colorado State College, has been appointed director of the School of Civil Engineering at Cornell University, filling the vacancy caused by the death of **William L. Malcolm,** M. ASCE. Dr. Christensen has taught at the California Institute of Technology and the University of Southern California, and since 1938 has been dean of engineering at Colorado State College and chairman of the engineering division of the Colorado Agricultural Experiment Station. On leave of absence from 1942 to 1945, he served, successively, as chief engineer of the Ballistics Research Laboratory and chief of the research branch of the Rocket Research Division at the Aberdeen, Md., Ordnance Research and Development Center.


N. A. Christensen

Walker R. Young, who retired on July 1 as chief engineer of the U.S. Bureau of Reclamation, was awarded the Department of Interior's gold medal for distinguished service in the civilian branch of the government in absentia at recent ceremonies in Denver. Mr. Young was unable to receive the award in person because of being abroad on a government mission. On the staff of the Bureau of Reclamation for 37 years, Mr. Young served as construction engineer on the building of Hoover Dam and carried out many other notable reclamation assignments. More recently he was supervising engineer for the Central Valley Project. In the award he was cited "for distinguished service, in recognition of an eminent career in the government service. . .covering the entire scope of engineering accomplishments."

Marcel Garsaud has resumed his consulting engineering practice, with a home office in New Orleans, La., and office connections in New York City. Of recent years Mr. Garsaud has been serving as director of the Dade County (Florida) Port Authority, with headquarters at Miami Springs.

Lewis K. Sillcox, first vice-president of the New York Air Brake Co., Watertown, N.Y., has received the honorary degree of L.L.D. from Syracuse University. Another member similarly honored during the recent commencement season was **George R. Rich,** member of the Boston firm of Charles T. Main, Inc., who received the doctor of engineering degree from Worcester Polytechnic Institute.

Franklin Thomas, member of the board of directors of the Metropolitan Water District of Southern California, has been elected chairman of the Colorado River Board, which was formed for study of the problems of the Colorado River, particularly as they affect the rights and interests of California. Professor Thomas, a former Director and Vice-President of the ASCE, is dean of students at the California Institute of Technology.

Arthur J. Bulger, formerly vice-president of Frederic R. Harris, Inc., of New York, and for some years with that firm on the West Coat, has moved to Philadelphia, Pa., where he will serve as director and executive vice-president of Vacuum Concrete, Inc.

J. Giles Foushee recently accepted the position of associate public health engineer in the sanitation division of the City of Charlotte Health Department, Charlotte, N.C. His duties will include insect and rodent control and other phases of environmental sanitation. Mr. Foushee's experience includes assignments with various municipalities, the Navy Bureau of Yards and Docks, the Tennessee Valley Authority, and the Sanitary Corps of the Army.

E. R. St. John, consulting engineer of Forest Hills, N.Y., has established a branch consultation office at 642 Madison Avenue, New York City.

Cherry L. Emerson, for the past three years dean of engineering at the Georgia Institute of Technology, will fill the newly created post of vice-president of research, extension, and construction at the Institute. He will have charge of the Engineering Experiment Station, the Engineering Extension Division, the Buildings and Grounds Division, and the new Construction Division.

Capt. Paul J. Halloran, who is retiring from the Civil Engineer Corps of the Navy, has been elected vice-president of Foley Brothers, Inc., construction firm of Pleasantville, N.Y. During his 27 years of service with the Navy, Captain Halloran has been in charge of several large construction projects for the Bureau of Yards and Docks. In the recent war he commanded the assault Seabees in the Marianas campaign, and organized and headed the Sixth Naval Construction Brigade. His most recent assignment has been as district civil engineer for the Fifth Naval District.

Stanley H. Wright, until lately head of a group of engineers with the Estimates Division of the Bureau of the Budget, has now joined the staff of the Engineering Division of the Atomic Energy Commission, with headquarters in Washington, D.C.

W. E. R. Covell, partner in the New York City consulting firm of Parsons, Brinckerhoff, Hall & Macdonald, has assumed the post of director general of the firm's new contract with the General Administration of Water and Electrical Energy of the Republic of Argentina, involving construction of a hydroelectric power and irrigation development in the northwestern part of the country. General Covell joined the firm in 1946 after completing an assignment as chief of the Services of Supply for the China-Burma-India Theater. The staff of the Buenos Aires office, serving under him, includes the following ASCE members: **L. Douglas Kingsland,** executive assistant, formerly in the Bogota, Colombia, office of the firm; **Charles M. Wellons,** chief engineer, until recently in the Pittsburgh District office of the Army Corps of Engineers; **William L. Voorduin,** chief of the Technical Planning Division, who recently returned from work on irrigation development in India; and **Wilson V. Binger,** chief soils engineer, who has just completed a similar assignment for the Army Corps of Engineers on the Missouri River project.

Worth B. Baldwin has resigned as resident engineer in the U.S. Engineer Office at Fort Bragg, N.C., after six years service in the Army Corps of Engineers, to take a position as engineer with the L. B. Gallimore construction firm of Greensboro, N.C.

Adil Belgin is returning to his home in Istanbul, Turkey, after studying engineering in the United States. He received the degree of doctor of science in civil engineering from the University of Michigan at the recent commencement exercises.

Douglas E. Dreier, for the past three years on the engineering staff of Walker Process Equipment, Inc., Aurora, Ill., has assumed charge of the engineering service department. He will handle all application engineering, propositions, estimates, and bids.

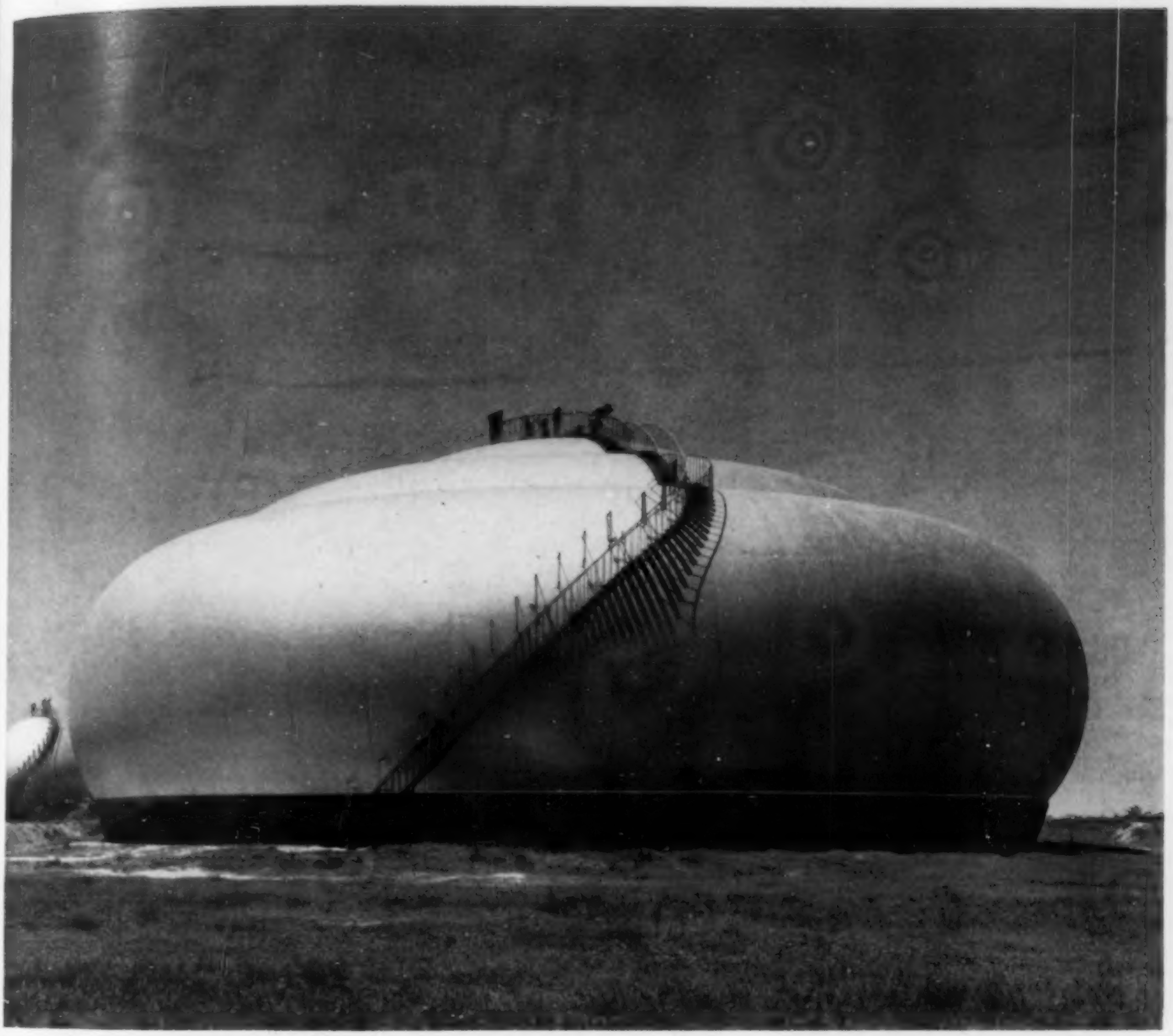
Justin S. Beer has opened his own engineering office at 20 South Broadway, Yonkers, N.Y. He was previously on the engineering staff of Muth & Maxwell, Inc., of Yonkers.

Arthur W. Kidder recently received a gold medal and distinguished service certificate from the Department of the Interior for his "outstanding skill in the performance of his duties as a cadastral engineer and as an astronomer" during more than 45 years in government service. From 1900 to 1947 Mr. Kidder was engaged in surveying work in the General Land Office and the Bureau of Land Management of the Department of the Interior. At present he is a member of the firm of Kidder & Thoma, cadastral engineers, with offices in Terre Haute, Ind., and Washington, D.C.


Arthur W. Kidder

Warren E. Wilson recently became president of the South Dakota School of Mines and Technology at Rapid City. He has taught at Tulane and Wayne Universities and headed the department of mechanics at the Colorado School of Mines. As chairman of the department of fluid mechanics of the Armour Research Foundation, Chicago, he supervised extensive industrial research programs during the war. Active in the field of hydraulic machinery, he formed the Committee on Hydraulic Power Transmission of the American Society of Mechanical Engineers, of which he is now chairman.

Raymond R. Blickle has been transferred from the Sugar Creek, Mo., office of the M. W. Kellogg Co., to Jersey City, N.J.



The HORTONSPHEROID . . . . protection for volatile products

When the Warren Petroleum Company required storage facilities for natural gasoline at its Texas City terminal, it chose Hortonspheroids, one of which is shown above. This type of storage tank is widely used at terminals and refineries for handling products that range in volatility from motor gasoline to natural gasoline, because it provides maximum protection against evaporation losses at minimum cost.

The Hortonspheroid provides several distinct advantages not found in other types of storage tanks. They are:

Dependable Operation—If the vent valves and other fittings are inspected regularly and kept in good working condition, the Hortonspheroid will operate under all climatic conditions with little or no maintenance costs, since there are no moving parts to get out of order.

Low Operating Cost—No power is used for compression, refrigeration, etc., and the attention of an operator is not required.

Durability—The rich vapor mixture maintained in the Hortonspheroid at all times, helps to prevent corrosion on the inside of the tank.

Fire Safety—The air vapor mixture in a Hortonspheroid usually has a richness above the ignition range, and the danger of fire is minimized.

Our new Bulletin E describes the Hortonspheroid in detail. If you need pressure storage to do a better job in your field, read the full story of this Horton tank. Write our nearest office for your bulletin today.

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Birmingham 1.........596 N. Fiftieth St.
Boston 10........1009-101 Devonshire St.
Chicago 4.........2199 McCormick Bldg.
Cleveland 15........2263 Guildhall Bldg.
Detroit 26..........1541 Lafayette Bldg.
Havana................402 Abreu Bldg.
Houston 2...2128 National Standard Bldg.
Los Angeles 14.......1456 Wm. Fox Bldg.
New York 6....3395—165 Broadway Bldg.
Philadelphia 3,.1652-1700 Walnut St. Bldg.
Salt Lake City 11509 1st Security Bank Bldg.
San Francisco 11.1284-22 Battery St. Bldg.
Seattle.................1309 Stuart Bldg.
Tulsa 3................1647 Hunt Bldg.

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNA.

John Lansdale has retired as valuation engineer and tax commissioner for the Southern Pacific Lines in Texas and Louisiana, with headquarters at Houston, Tex., after 42 years in railroad work. Colonel Lansdale will make his home on an ancestral tobacco farm near Cumberstone, Md.

Adolf Hinrichs, previously director of public works for the City of New Rochelle, N.Y., has accepted the position of chief structural engineer with Wearn, Vreeland, Carlson & Sweatt, Inc., power consultants and constructors, of New York City.

G. R. Goffin is now chief engineer and manager of the Department of Works of the Brisbane City Council, Brisbane, Australia.

George P. Seeley for many years vice-president of the Frederick Snare Corp., contracting engineers of New York, has been elected president of the organization, succeeding **Arthur W. Buttenheim** who will fill the post of chairman of the board of directors.

Francis D. McHugh and **Theodore T. McCrosky** announce the establishment of a consulting service to private and public agencies for community and regional development problems. The new firm, to be known as McHugh & McCrosky, will be located at 23 East 26th Street, New York City.

Walter L. Couse, general contractor of Detroit, Mich., has been appointed to the advisory council of the Senate Interstate Commerce Subcommittee on Trade Policies, which is investigating the effect on the national economy of Supreme Court and Federal Trade Commission price decisions. Mr. Couse, who is a member of the executive committee of the Associated General Contractors of America and chairman of the organization's Market Development Committee, will present to the council the problems of the contract construction industry relating to pricing policies.

Frank I. Louckes has retired as engineer in the U.S. Engineer Office at Memphis, Tenn., after 33 years in the Army Corps of Engineers. Mr. Louckes has been in the Memphis District since 1929, and for the past two years has had the title of special assistant to the chief of the Engineering Division. His most recent assignment has been directing the development of a new V-type mattress for protection of concrete banks.

George F. Nechwort, formerly with the Dredging Division of the Panama Canal, has gone to Liberia, where he is engaged on bridge and road construction for the Raymond Concrete Pile Co.

G. A. Riedesel has resigned as head of the civil engineering department at the University of Idaho to head the firm of G. A. Riedesel & Associates, consulting engineers with headquarters at Moscow, Idaho.

Robert L. Sumwalt, dean of the school of civil engineering at the University of South Carolina, has been elected chairman of the South Carolina State Board of Engineering Examiners for the fiscal year beginning July 1. **F. R. Sweeny,** of Anderson, has been elected vice-chairman, and **T. Keith Legare,** of Columbia, secretary. The other members of the board are **Harwood Beebe,** of Spartanburg, and **L. S. Le Tellier,** of Charleston.

G. A. Heft has formed the consulting engineering firm of G. A. Heft & Co., with offices at 820 Union Street, New Orleans, La., for the continuation of the general practice of engineering. Mr. Heft was formerly associated with **David W. Godat** in the New Orleans firm of Godat & Heft.

F. T. da Silva Telles, technical manager of the Sociedade Constructora Brasileira, Ltda., São Paulo, Brazil, was a recent visitor at Society Headquarters. Mr. Telles is acting chairman of the newly formed Brazil Section of the ASCE.

P. T. Samuel is retiring as chief of the Marine Division of the Philadelphia District of the Army Corps of Engineers after 30 years in government service. His work in the Corps of Engineers includes assignments as chief of the Administrative Division of the San Francisco District and senior administrative engineer in the Plant and Equipment Section of the Office of the Chief of Engineers, Washington, D.C. As chief of the Marine Division at Philadelphia since 1939, Mr. Samuel was in charge of the Division's accelerated program of design and construction of floating plant for military operations.

Boris W. Boguslavsky has resigned as professor of structural engineering at the University of Akron to accept the position of professor of architectural engineering at the Georgia Institute of Technology.

Deceased

Michael Joseph Burke (M. '35) assistant planning engineer for the Chicago Park District, Chicago, was killed in an automobile accident at Great Lakes, Ill., on January 19, according to word just received at Society Headquarters. Mr. Burke, who was 54, had been with the City of Chicago for a number of years as assistant engineer for the Park District and resident engineer for the Board of Local Improvements. During the recent war he served as a commander in the Civil Engineer Corps of the Navy.

Joseph Patrick Carlin (M. '10) president of the P. J. Carlin Construction Co., of New York City, died at his home at East Brightwaters, N.Y., on July 6. His age was 72. The firm that Mr. Carlin headed for many years was founded by his grandfather in 1850 and expanded by his father. He was also president of the 209 West 38th Street Corp. and of the 260 West Street Corp. Mr. Carlin was a veteran of the first World War, resigning his commission as a major after serving in an overseas ordnance division.

Oliver W. Childs (M. '02) retired civil engineer of Denver, Colo., died on July 13, at the age of 82. Mr. Childs had been first deputy street commissioner of St. Louis in charge of the Bridge Division; senior highway engineer for the U.S. Bureau of Public Roads (now the Public Roads Administration); superintendent of the Denver Steel & Iron Works Co.; and chief engineer of the Monarch Engineering Co., at Denver. From 1934 until his retirement in 1943 he was structural designer for the Colorado State Highway Department.

Jose Maria Ibarra Cerezo (Assoc. M. '16) civil engineer in the Public Works Department of Caracas, Venezuela, died recently at the age of 74. A native of Venezuela, Mr. Ibarra Cerezo was educated there and in the United States and France. Early in his career he was engaged on land surveys, and for three years was a member of the Anglo-Venezuelan Commission for determining the boundary line between Venezuela and British Guiana. Beginning in 1914, he was for a number of years director of the Department of Ways and Communications in the Venezuelan Ministry of Public Works.

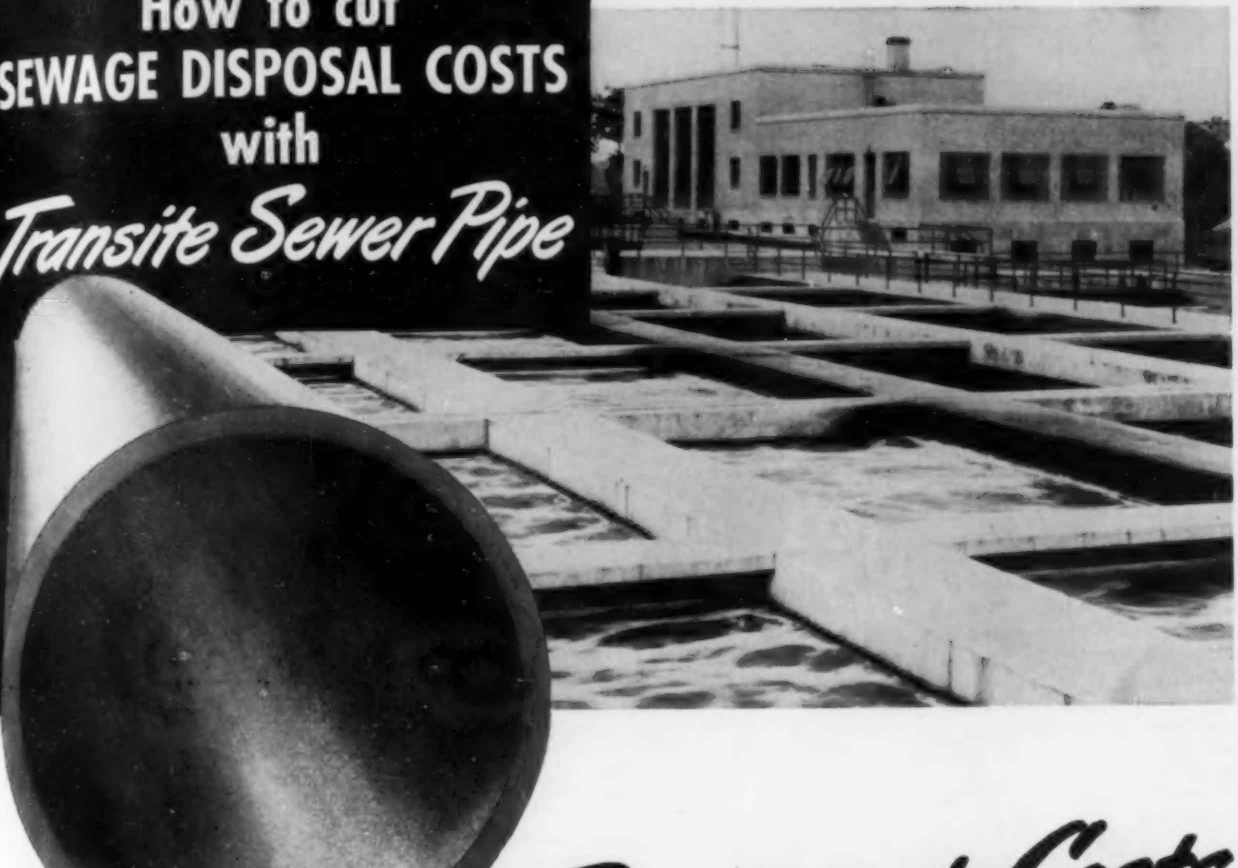
Robert Bond Jennings (M. '46) district manager of the Trane Co., Columbus, Ohio, died recently. He was 47. From 1926 to 1938 Mr. Jennings was in the Columbus city engineering department. He then became connected with the Trane Co., leaving in 1942 for a four-year period of service in the Civil Engineer Corps of the Navy, in which he attained the rank of commander. Mr. Jennings had developed a process for pouring concrete pavement joints, and was the author of several articles on the subject.

Herbert Miller Knight (M. '10) died at his home in Upper Montclair, N.J., on August 18, at the age of 83. As a young man Mr. Knight did extensive work on developing the unique hydraulic air compression plant at Norwich, Conn., also on sanitation improvements for his native city, Providence, R.I., and for Baltimore, Md. Then followed contracting engineering on the New York State Barge Canal and elsewhere. For over 20 years until his recent retirement he served as contract engineer with the New York office of the Maryland Casualty Co.

Leo Kraemer (Affiliate '25) engineer for the Southern Pine Association, New Orleans, La., died in February 1947, according to word just received at Society Headquarters. Mr. Kraemer, who was 57, had been with the Southern Pine Association for the past twenty years. Earlier in his career he was superintendent for the E. M. Bent Co., of Chicago, on heavy timber and mill construction, and field adviser in charge of the Building Code Bureau of the National Lumber Manufacturers Association.

Harry Nelson Latey (M. '06) former chief electrical engineer of the New York Board of Transportation, died at his home in that city on July 11. Mr. Latey, who was 78, was with the Board of Transportation and its predecessor, the State Transit Commission, from 1920 until his retirement in October 1944. Earlier in his career he was with the Manhattan Elevated Railway Co., in charge of the electrification of the city's old steam-powered lines, and electrical engineer for the Interborough Rapid Transit Co.

How to cut SEWAGE DISPOSAL COSTS with *Transite Sewer Pipe*



Reduced Treatment Costs

Two features of Transite* Sewer Pipe present an opportunity for important savings in the treatment of sewage:

1. **Sleeve-type joints that make up tight and stay tight in service.**
2. **Long 13-foot lengths that mean fewer joints in the finished line.**

This double safeguard against infiltration—*tighter* joints as well as *fewer* joints—has the practical effect of reducing the load at the disposal plant ... often to the extent that overall treatment costs are substantially cut.

This reduction in sewage load also enables plant capacity to be conserved for future needs. And, where new treatment facilities are being planned, it permits consideration of a smaller plant . . . with possible economies in both buildings and equipment.

Transite offers other economies, too. Other important savings are possible with this pipe because it has an exceptionally smooth interior which offers minimum resistance to the flow of sewage. Its flow capacity is unusually high—n=.010. This often permits use of flatter grades and shallower trenches—with correspondingly lower excavation costs. Or, as an alternate economy, smaller diameter pipe may be used.

Low maintenance through the years. Made of asbestos and cement combined into a homogeneous material of great stability, Transite Sewer Pipe is corrosion-resistant. Tight joints safeguard against root trouble. And every Transite length is factory-tested for strength and uniformity. This adds up to low annual maintenance costs through the years.

For Further Information. If you are seeking ways to lower sewage disposal costs, send for the Transite Sewer Pipe brochure. Write Johns-Manville, Box 290, New York 16, N. Y., for your copy.

*Reg. U. S. Pat. Off.

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Transite Sewer Pipe

From 1906 to 1912 he was senior partner in the firm of Latey & Slater, railroad engineers and constructors.

James Talbott Madison (M. '20) retired engineer of Frankfort, Ky., died there on June 19. His age was 65. Except for a period of one year when he was in private practice, Mr. Madison was in the Kentucky State Highway Department from 1919 until his retirement in 1943—for a number of years as bridge engineer at Frankfort. Earlier he had done irrigation and reclamation work for Symmes & Means, consulting engineers of San Francisco, and during World War I served as a first lieutenant in the Army Corps of Engineers.

Irving Ellsworth Matthews (M. '22) retired engineer of Rochester, N.Y., died at his home there on June 28, at the age of 83. From 1911 until his retirement in 1933, Mr. Matthews was in the engineering employ of the City of Rochester, serving successively as assistant engineer in charge of water distribution, superintendent of the Rochester Water Works, director of design and construction, and deputy commissioner of the Department of Public Works. Following his retirement from municipal service, he maintained a consulting practice in Rochester. Mr. Matthews was a past-president of the Rochester Section of the ASCE, and a charter member of the Rochester Engineering Society.

Edwin Watts Owens (Jun. '40) assistant civil engineer in the U.S. Engineer Office at Norfolk, Va., died on July 2, at the age of 36. Mr. Owens had worked on the construction of the Mt. Vernon Memorial Highway near Alexandria, Va., and for the Tidewater Construction Corp., of Norfolk. From January 1932 to February 1933 and from July 1936 until his death, he was in the U.S. Engineer Office at Norfolk.

Roberto Cochrane Simonsen (M. '24) of São Paulo, Brazil, died in Rio de Janeiro on May 25, at the age of 60. Mr. Simonsen spent his early career in municipal engineering work for the city of Santos, resigning in 1912 to found the Companhia Constructora de Santos, a building and general construction organization. At the time of his death he was president of the company and of several other industrial organizations, as well as of the São Paulo Manufacturers Association. Prominent in the technical and professional development of Brazil, Mr. Simonsen was the author of several books and articles on engineering subjects.

Albert Smith (M. '20) consulting engineer of Chicago, Ill., died on March 18, at the age of 75. During the first World War, Mr. Smith served as a lieutenant colonel in the Army Corps of Engineers. He then became professor of structural engineering at Purdue University, resigning in 1922 to establish the Chicago consulting firm of Smith & Brown. Active on technical committees of the American Concrete Institute, Mr. Smith had written for its *Journal*. His writings had also been published by the Western Society of Engineers.

Ralf Woolley, Contributor to "Civil Engineering" Dies

WITH THE death of Ralf R. Woolley, M. ASCE, in Salt Lake City, Utah, CIVIL ENGINEERING loses the originator and conductor of its "Wool Gatherings" column. Mr. Woolley, whose first column of brief engineering facts appeared in the April 1947 number, mailed copy for the current issue on July 1, the day of his death.

Ralf R. Woolley

Born in Paris, Idaho, on September 13, 1884, Mr. Woolley received a degree in mining engineering from the University of Utah in 1909 and the civil engineering degree in 1920. He had been with the U. S. Geological Survey since 1917, for many years as senior hydraulic engineer at Salt Lake City, and was the author of numerous Geological Survey reports on water resources.

At the time of his death Mr. Woolley was a member of the advisory board on civil engineering for the University of Utah and a member of the board of engineering examiners for the State of Utah. For a number of years he published a "News-Letter" for the Utah Society of Professional Engineers. Active in the Intermountain Section of the Society, he served as president in 1947.

Air Conditioning and Blank Walls Introduce Fire Problems

(*Continued from page 21*)

ing systems be of the unit type, which obviates the need for ducts through floors or walls, thus preventing the spread of fire, heat, or smoke to other areas.

In addition to automatic controls, a system of push buttons on each floor to actuate the controls manually and to start the fan in a fire emergency during shutdown periods should be provided in all air-conditioning systems in blank-wall buildings, except those systems which operate continuously and are equipped with photo-electric smoke detection devices.

Fire-Fighting Equipment Essential

There must be ample fire-fighting equipment in a blank-wall air-conditioned building. Standard automatic-sprinkler protection should be provided wherever the construction or the occupancy is combustible. Thorough training of employees in fighting fires in air-conditioned areas is also essential. Members of the fire brigade should be made familiar with the use of smoke masks. Fire exit drills are part of a good safety program.

Frequency Factor Applied to Highway Bridge Computations

(*Continued from page 51*)

ture is to be built on a secondary road, that its estimated life is 40 years and that the average daily traffic is expected to be 500 vehicles. Then $6{,}600 \times 40 \times 0.5 = 132{,}000$ expected cycles of maximum stress. Referring to the diagram (Fig. 1) and interpolating between 100,000 and 600,000, it can be seen that for stresses fluctuating between, for example, maximum and approximately zero, the basic unit working stress may be used. If any of the parts of the structure will be subject to more than one cycle during the passage of the design load or to fluctuations of greater amplitude, the corresponding reduced unit working stress should be used for that part. Thus for full reversal, the designer should use a maximum unit working stress of slightly less than two-thirds (12,000/18,000) of the basic.

Or suppose that a structure is to be built near a large center of population where the traffic density may be 8,000 vehicles per day. If the estimated life of the structure is again taken as 40 years, then $6{,}600 \times 40 \times 8 = 2{,}112{,}000$ cycles. From Fig. 1 it is seen that for a maximum to half maximum fluctuation the basic unit stress can be used. For a maximum to zero fluctuation, a unit stress of about three-fourths (13,500/18,000) of the basic should be used. If, for some reason, the structure is to be in service for only a short term of years, a somewhat higher unit stress would be permitted, even in this zone of dense traffic.

Comparison with Rule-of-Thumb Method

It is quite possible that some designers will disagree with the positions or shapes of the curves in Fig. 1 or with other details of this method, or will point out such difficulties as those involved in predicting the length of life of structures or future traffic densities. Nevertheless, it is claimed that, contrasted with the current rule-of-thumb procedure of choosing between two or three weights of live loads, the proposed system is an improvement since it embodies use of the logical factors of one maximum legal load and the number and amplitude of the expected stress cycles.

Advantages of Wide-Angle Lenses in Aerial Mapping

(*Continued from page 25*)

which light for the rectifying system is supplied by a high-pressure mercury arc (see illustration). Because the optical system is not corrected for color, a filter is employed to admit approximately monochromatic light. In effect, the rectifier introduces positive distortion; that is, it magnifies the marginal parts of the picture more than the center, thus compensating for the negative distortion in the original photograph. Actually a small amount of distortion remains in the print after rectification, and this distortion is in fact too large for American photogrammetric practice.

Negative distortion tends to increase the uniformity of the effective exposure as compared with an exposure made with a distortion-free lens. Large positive distortion, as in the optical system of the rectifier, exaggerates the unevenness of illumination. Greater magnification at the edge as compared with the center of the picture further decreases the exposure of the marginal points, which ordinarily would have received relatively less exposure. In laboratory copying apparatus, this characteristic is not particularly serious, because the relative illumination of the different parts of the picture is under control and can be adjusted to give uniform exposure on the final photograph. In the German rectifier a filter of graduated density, lighter from the center outward, is used to balance the illumination.

Modern Design Produces Sound Concrete in Ross Dam

(*Continued from page 31*)

proud of the excellent results being obtained as were the owners.

Concrete was placed in three shifts, mostly by the swing and graveyard shifts, as the single highline was used during much of the day shift for moving forms and unloading and placing materials.

All mixing-plant operators and placement foremen were experienced men, capable and efficient in this class of work. Good-natured rivalry was encouraged between placement crews. Workmen coming on duty would arrive early in order to inspect the work of the previous crews and any inferior work found, provided cause for plenty of razzing. Talks and discussions pertaining to concrete were given to the crews by the Resident and Assistant Resident Engineer when opportunity offered and literature was provided and read. It was recognized that a number of the placement men would make good concrete inspectors. Such tactics kept interest alive and helped greatly in the proper execution of the work.

Vibrator men decidedly liked dry concrete as they could do their work without sinking deeply into the mass. Tugging their rubber-boot-encased feet out of wet, heavy, sticky concrete tired them more than doing the small amount of extra vibrating that might be necessary with concrete of 1 to $1^1/_2$-in. slump, the consistency they preferred—a very pleasing situation.

General Observations

While wholeheartedly appreciative of the valuable services rendered by research laboratories, the writer believes that the performance and behavior of actual structures is the primary and basic consideration. Model findings in relation to prototype behavior require further research. American engineering would advance markedly if there were more study and discussion of performance under the exact conditions of temperature, exposure, and other forces to which only the prototype can be subjected.

No admixtures of air entraining agents were used in the concrete for Ross Dam. Constant inspection of all the concrete in the City of Seattle's Skagit River Development, initiated in 1919, has been made. This concrete, composed of river-bar aggregates and cement from the same source as that used in Ross Dam, reveals no evidence of reactive expansion or of frost disintegration although it has been subjected to temperatures ranging from -5 to $+100$ deg F. Therefore no need was felt for anything except the same good cement and the same good aggregate in Ross Dam.

The writer is of the opinion that the use of so-called puzzuolanic admixtures, volcanic ash, diatomites, finely-divided silicas, etc., has in general proved more harmful than beneficial because he knows of no such admixture whose use does not result in a more absorbent concrete. The writer also believes that the use of much less than 1 bbl of cement per cu yd in the concrete of hydraulic structures expected to endure for many decades, will not produce the degree of density and impermeability necessary to prevent solvent action and frost disintegration in severe climates.

After his many years of experience with both large and small concrete structures in the Northwest, the writer cannot overemphasize the importance of responsible and continuous on-the-job inspection. Effective control of mixing, placing, and curing concrete can produce fairly good results with mediocre materials, but lax inspection and poor control can and does result in many failures even with the use of materials of the highest quality obtainable.

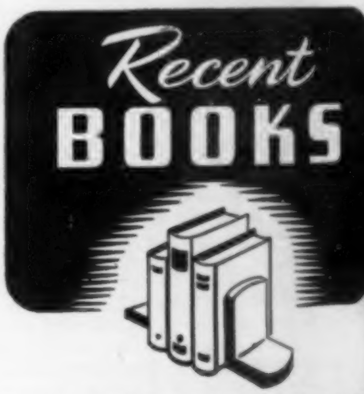
Progress of Work on Brooklyn-Battery Tunnel

(*Continued from page 24*)

nels. George H. Flinn Corp., New York, holds the other contract.

The Triborough Bridge Tunnel Authority, of which Ralph Smillie, M. ASCE, is chief engineer, is building the Brooklyn-Battery Tunnel project. The Grow Construction Co., New York, Charles Goodman, M. ASCE, president, is the contractor on the artificial-island caisson work described here. Eugene F. Gibbons and George A. Fox, Jun. ASCE, are engineers for the Grow Co., and Robert Goodman, its secretary, is supervising the project.

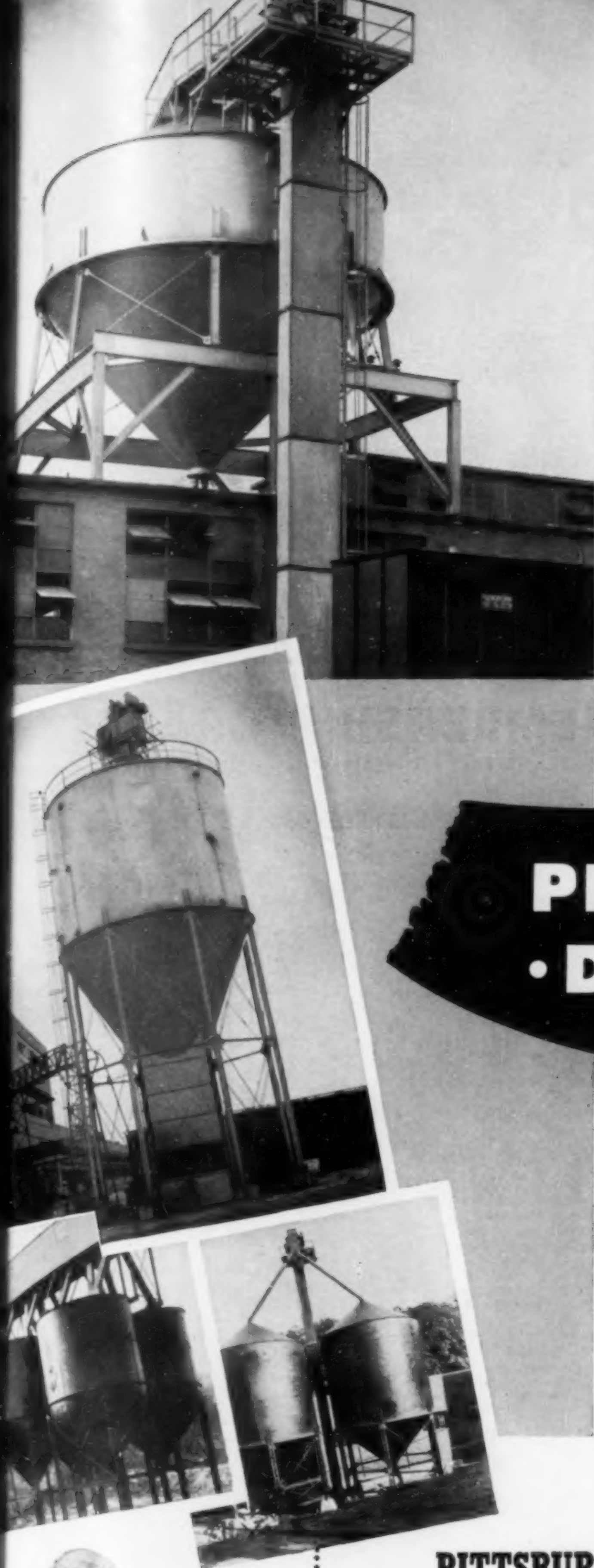
Photos and some of the data presented in this article and on the front cover of this issue are used through the courtesy of Lone Star Cement Corporation.



COURS DE MECANIQUE, Vol. 2, DYNAMIQUE DES CORPS SOLIDES RIGIDES. By H. Favre. Dunod, Editeur, Paris; Leemann Fres., Editeurs, Zurich, Switzerland, 1947. 434 pp., diagrs., tables, $9^1/_4 \times 6^1/_4$ in., paper, 1380 frs. Written for engineers, physicists and mathematicians who wish to acquire an over-all view of classical mechanics, this book not only presents the theory but gives the formulas in a direct method applicable to concrete cases. This second volume covers the dynamics of points, rigid bodies, and systems with a full analytical treatment. Problems for student solution follow each chapter. Volume I of the series covered statics, and Volume III will deal with the theory of elasticity, elastic bodies, and hydrodynamics.

(The) EFFICIENT USE OF STEAM, written for the Fuel Efficiency Committee of the Ministry of Fuel and Power. By O. Lyle. His Majesty's Stationery Office, London, England, 1947. 912 pp., diagrs., charts, tables, 10×6 in., cloth, [illegible] This comprehensive work, a companion volume to the previously published "Efficient Use of Fuel," discusses the design, operation, control, and maintenance of equipment for the use of heating, power, and process steam. The neces-

(*Continued on page 84*)



(Continued from page 82)

sary minimum of theory is given, accessories are covered in detail, necessary tables and formulas are appended for quick reference, and a detailed index is provided.

ELEMENTARY STRUCTURAL ANALYSIS. By J. B. Wilbur and C. H. Norris. McGraw-Hill Book Company, New York, 1948. 523 pp., illus., diagrs., charts, tables, 9¼ × 6 in., cloth, $6. Intended for use in undergraduate courses, this book stresses the relation of structural theory to applied mechanics, and the application of basic principles to widely varying types of structures. It discusses airplane, ship, and chemical engineering structures, as well as those more usual to civil engineering. Analysis is made by means of models as well as by mathematical and graphical methods. Numerous illustrative problems show efficient methods of setting up various problem types.

ORGANIZING SCIENTIFIC RESEARCH FOR WAR. (Science in World War II, Office of Scientific Research and Development.) By I. Stewart, foreword by V. Bush. Little, Brown and Company (Atlantic Monthly Press Book), Boston, 1948. 358 pp., tables, 8¼ × 5½ in., cloth, $5. This volume sets forth the details of the actual organization of the nation's scientists after they were mobilized for war. It outlines the overall committees, special committees, divisions, panels, and the chairman's office of OSRD, as well as the various research groups and the office of Field Service. It tells how liaison was achieved with the armed services and allied governments, and how the administrative office functioned. Finally it surveys the process of demobilization and evaluates the procedures of the OSRD as a whole.

Books in the Engineering Societies Library may be borrowed by mail by ASCE members for a small handling charge. The Library also prepares bibliographies, maintains research and photostat services, and can provide microfilm copies of any item in its collection. Address inquiries to Ralph H. Phelps, Director, Engineering Societies Library, 29 West 39th Street, New York 18, N.Y.

STEAM, AIR AND GAS POWER. By W. H. Severns and H. E. Degler. 4th ed. John Wiley & Sons, New York; Chapman & Hall, Ltd., London, 1948. 509 pp., illus., diagrs., charts, tables, 9¼×6 in., cloth, $4.75. This standard text gives the student of power engineering the basic information he will use in his daily work. It presents modern practice with sufficient technical detail and mathematical calculation. Clear discussions and illustrations show the underlying theory of the construction, applications, and performance of modern heat-power plants and their correlated equipment. New material on the gas turbine and other recent developments have been added to this edition including new problems.

TABLES OF BESSEL FUNCTIONS OF FRACTIONAL ORDER, prepared by the Computation Laboratory of the National Applied Mathematics Laboratories, National Bureau of Standards. Volume I. Columbia University Press, New York, 1948. 413 pp., 10¾×7¾ in., cloth, $7.50. The purpose of this book is to provide tables of Bessel Functions of fractional orders, other than one-half, which frequently occur in practical applications. The fractional orders of ¼, ⅓, ⅔, and ¾ are given to either ten decimal places or ten significant figures. A bibliography on Bessel functions is also included. The present volume contains tables of $J_\nu(x)$, while a companion volume, to be published later, will give the tabulation of $I_\nu(x)$.

TRENDS IN ENGINEERING EDUCATION. By James Kip Finch, M. ASCE. Columbia University Press, New York, 1948. 131 pp., 8×5½ in., cloth, $2. Two problems confronting many schools of engineering today are discussed in this book by the dean of engineering at Columbia University in the light of the treatment given them in Columbia's school of engineering. One of the problems has been the move to broaden engineering curricula to include the basic subjects of a general education; the other is the challenge schools face today in advancing both the fundamentals and the applications of engineering science. The book stresses the change from a highly practical program that emphasized technique, to new plans which emphasize the development of basic theory.

CHANGES IN MEMBERSHIP GRADES

ADDITIONS, TRANSFERS, REINSTATEMENTS, AND RESIGNATIONS

From July 10 to August 9, 1948

Additions to Membership

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Associate Members	9,270
Corporate Members	16,420
Honorary Members	40
Juniors	7,370
Affiliates	73
Fellows	1
Total	23,904
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TRAX, PAUL THOMAS (Jun. '48) Junior Engr., The Pennsylvania R.R., Altoona (Res., R.D. 2, Franklin), Pa.

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VIEST, IVAN MIROSLAV (Jun. '48) Student, Georgia Tech., Atlanta, Ga. (Res., Care, Manda & Slabey, 7-11 West 45th St., New York, N.Y.)

WALSH, RAYMOND (Jun. '48) Junior San. Engr., East Bay Municipal Utility Dist., 512 Sixteenth St., Oakland (Res., 2519 Ridge, Berkeley), Calif.

WALTRIP, WALTER CLAUDE (Jun. '48) 118 Thirty-fifth St., S.E., Washington 19, D.C.

WARD, JAMES JOSEPH (Jun. '48) P.O. Box 4, Oroville, Calif.

WATKINS, IRVING CARL (Assoc. M. '48) Asst. Engr., Howard, Needles, Tammen & Bergendoff, 921 Walnut St. (Res., 5626 Harrison St.), Kansas City 4, Mo.

WEIL, CECIL (Jun. '48) Junior Engr., Lone Star Gas Co., 301 South Harwood (Res., 1225 Pennsylvania Ave.), Dallas 15, Tex.

WEINBERG, BERTOLD ERNST (Jun. '48) Eng. Design, Albany Designing Inc., 927 Broadway (Res., 52 South Main Ave.), Albany 3, N.Y.

WETTER, GIORGIO (M. '48) Dottore Ingegnere, Direttore dell'Instituto Geotecnico Rodio, Corso Vittorio Emanuele 29 (Res., Via Venini, 48), Milano, Italy.

WHALEN, RAYMOND JOSEPH (Jun. '48) 158 Elizabeth Ave., Hempstead, L.I., N.Y.

WHITE, ROBERT LEWIS (Jun. '48) Junior Civ. Engr., Highway Dept., 2nd & Spring Bldg. (Res., 1624-B Magnolia Ave.), Los Angeles 6, Calif.

WIGMAN, TYS IV (Jun. '48) Eng. Aid III, Los Angeles County Flood Control Dist., 1740 Eastlake Ave., Los Angeles (Res., 715 Brent Ave., South Pasadena), Calif.

WILKIE, GEORGE THEODORE (Jun. '48) Designer and Detailer, Sverdrup & Parcel, Inc., 915 Olive St., St. Louis 1, Mo.

WILLIAMS, CHARLES EDGAR, JR. (Jun. '48) Draftsman, McKoy-Helgerson Co., Box 25, Greenville (Res., Route 2, Taylors), S.C.

WILSON, FRANK ELVYN (M. '48) Asst. Prof. of Structural Eng., Fenn College, East 24th & Euclid Ave., Cleveland (Res., 1079 Parkside Drive, Lakewood 7), Ohio.

WILSON, ROBERT LESLIE (Jun. '48) Junior Civ. Engr., State Div. of Highways, P.O. Box 841 (Res., P.O. Box 807), San Luis Obispo, Calif.

WIMBERLY, CLIFFORD MCBRIDE (Jun. '47) Highway Engr., Arabian American Oil Co., Dhahran, Saudi, Arabia.

WISE, LOUIS WILLIAM (Jun. '48) Civ. Engr., Public Works Dept. (Res., Box 67, Lindsey St.), Attleboro, Mass.

WURTELE, GEORGE REID (Jun. '48) Instrumentman, Louisville & Nashville R.R., 1909 Morris Ave. (Res., 4118 Terrace R, Central Park), Bi[rmingham] 8, Ala.

ZIGNEGO, LEROY CHARLES (Jun. '48) Civ. Engr. I, Bureau of Sewers, Room 405, City Hall (Res., 2925 North Downer Ave.), Milwaukee 11, Wis.

ZIGNEGO, VERNON THOMAS (Jun. '48) Civ. Engr. I, Bureau of Street Constr. & Repair, City Ha[ll] (Res., 2925 North Downer Ave.), Milwaukee 11, Wis.

ZUMSTEIN, ROBERT HAROLD (Jun. '48) Instr., Wayne Univ., 4841 Cass (1), Box 64, Detroit, Mich.

Membership Transfers

BICKERSTAFF, RAYMOND MAYHEW (Jun. '3[?]; Assoc. M. '48) Vice-Pres. and Chf. Engr., Tran[s]rail Eng. Inc., 417 Market St., San Francis[co] (Res., 5711 Harbord Drive, Oakland 11), Calif.

BOLZER, MORRIS SAMUEL (Jun. '39; Assoc. M. '48) Job Engr., Pacific Bridge Co., Box 125, E[l] Segundo (Res., 13413 Grape Ave., Compton), Calif.

BOWMAN, WALDO GLEASON (Jun. '26; Assoc. M. '29; M. '48) Editor, McGraw-Hill Publish[ing] Co., 330 West 42d St., New York (Res., 2[?] Ridge Rd., Douglaston, L.I.), N.Y.

BROWN, WALTER ALBERT, JR. (Jun. '42; Assoc. M. '48) Designer and Estimator, American Brid[ge] Co., 1418 Frick Bldg., Pittsburgh (Res., [?] Maplewood Ave., Ambridge), Pa.

CZEL, JAMES EUGENE, JR. (Jun. '35; Assoc. M. '48) 74 Circular Ave., Bridgeport 5, Conn.

DAHL, LESLIE HOWARD (Jun. '35; Assoc. M. '4[?]) Roadmaster, Northern Pacific Railway, Laur[el], Mont.

DAVEY, GEOFFREY INNES (Assoc. M. '40; M. '4[8]) Cons. Engr., Gutteridge Haskins & Davey, B[ox] 310 F, G.P.O., Sydney, N.S.W., Australia.

DAVIES, CLARENCE WILLIAM EDWARD (Jun. '[?]; Assoc. M. '48) Project Engr., American Loco[motive] Co. (Res., 604 Fairmont St.), Latrobe, P[a].

DUFFEE, LOUIS WARREN (Assoc. M. '13; M. '4[8]) Chf. Eng. Section, Federal Works Agen[cy], Bureau of Community Facilities, 114 Mariet[ta] St. (Res., 1285 Oxford Rd., N.E.), Atlanta, Ga.

DUKES, WILLIAM WEAVER (Jun. '36; Assoc. M. '48) Asst. Chf. Engr., Central Indiana Coal C[o.] and Sherwood Templeton Coal Co., 289 Nor[th] Main St. (Res., 489 First St. N.W.), Linton, Ind.

ELLIOT, REED ARCHER (Assoc. M. '39; M. '4[8]) Chf. Project Planning Branch, Tennessee Valle[y] Authority, 516 Union Bldg., Knoxville, Tenn.

ERNEST, WALTER CRENSHAW, JR. (Assoc. M. '4[?]; M. '48) (Ernest Constr. Co.), 1810 Old Shell Rd., Mobile, Ala.

EUSTIS, JOSEPH BRES (Jun. '39; Assoc. M. '4[?]) Cons. Engr. (Eustis Engr. Co.), 922 Grove St., Vicksburg, Miss.

FEHRMAN, ROLLIE GREGG (Jun. '43; Assoc. M. '4[8]) Soil Mechanics Engr., U.S. Engrs., 10 East 17[th] St., Kansas City (Res., 1306 South 20th St., S[t.] Joseph), Mo.

FOOKS, JACK HERBERT (Jun. '41; Assoc. M. '4[8]) San. Engr., U.S. Public Health Service, Cinci[n]nati, Ohio. (Res., 32 Ridge Rd., Linwood, Pa.)

GARRISON, CARMAN WILLIAM (Jun. '38; Assoc. M. '48) Supt., Allen N. Spooner and Son Inc., P[ier] Eleven, North River, New York, N.Y. (Res., [?] Norwood Terrace, Millburn, N.J.)

GAVETT, WESTON (Assoc. M. '24; M. '48) Ass[o]ciate, Clyde Potts, 30 Church St., New York, N.Y. (Res., 973 Kenyon Ave., Plainfield, N.J.)

GERARDI, ANGELO PETER (Jun. '40; Assoc. M. '48) Chf. Engr., Procurement Section Hea[d]quarters, Eighth Army, A.P.O. 343, Care, Pos[t]master, San Francisco, Calif.

GIGSTAD, KNUT (Assoc. M. '37; M. '48) Asst. C[iv.] Engr., Board of Water Supply, Neversink, N.Y.

GRIFFITHS, THOMAS WILLIAM (Jun. '37; Assoc. M. '48) 1812 Meridian Ave., Alhambra, Calif.

GRUY, ANDREW MELROSE (Jun. '37; Assoc. M. '48) Civ. Engr., Humble Oil & Refining Co., P.O. Box 2180, Houston 1, Tex.

HAMM, ALTON SINCLAIR (Jun. '38; Assoc. M. '4[8]) Asst. Prof. of Civ. Eng., Univ. of Maine, 25 W[in]gate Hall (Res., 18 Grove St.), Orono, Me.

HEDIN, WILLIAM NELS (Jun. '34; Assoc. M. '4[8]) Engr., Estimator, Nels Hedin, Gen. Contr., 2[?] Federal Ave., Seattle 2, Wash.

HOFELDT, HENRY, JR. (Assoc. M. '42; M. '48) C[?] Engr., Weiskopf & Pickworth, 45 West 45th St., New York 19, N.Y.

IRWIN, JOHN PAULETTE (Jun. '37; Assoc. M. '[48]) Engr., 214 Bennett Bldg., Ottawa, Kans.

JONES, DRAHN (Jun. '42; Assoc. M. '48) Eng[r.], Homer A. Hunter, Cons. Engr., 6403 Bob-O-Li[nk] Drive (Res., 6421 Kenwood St.), Dallas 14, T[ex].

JONES, PAUL SIDNEY (Jun. '12; Assoc. M. '18; M. '48) Hydr. Engr., U.S. Bureau of Reclamati[on], Calif. Fruit Bldg., Sacramento (Res., Route [?], 1195, Fair Oaks), Calif.

(Continued on page 93)

Men Available

CIVIL-SANITARY ENGINEER; M. ASCE; married; 30 years wide experience, design and supervision of construction of public works, water supply, purification and treatment; sewerage and sewage treatment; power generation; investigation, reports; project promotion, consulting, California license. Available immediately. Prefers Western states but will go anywhere. C-444.

RECENT GRADUATE; Student Chapter Member; 22; single; bachelor of civil engineering from Catholic University of America; desires employment in Latin America as Junior Civil Engineer for construction or petroleum firm. Fair knowledge of Spanish. Available September 1. C-445.

CIVIL ENGINEER; 27; married; 3 years' experience in design, layout and drafting of aircraft parts prior to graduating in civil engineering; limited experience in highway engineering; desires position with chance for advancement; location Eastern U.S.; available Oct. 1. C-446.

Positions Available

TEACHING PERSONNEL. (*a*) Professor of Civil Engineering, for sanitary, surveying or hydraulic courses (not structural). Salary, $5,400. (*b*) Assistant Professor of civil engineering, to teach surveying, hydraulics or sanitary engineering. Salary, $3,780. (*c*) Instructor in civil engineering to teach strength of materials and applied mechanics. Salary, $2,940. Y-536.

This placement service is available to members of the Four Founder Societies. If placed as a result of these listings, the applicant agrees to pay a fee at rates listed by the service. These rates—established to maintain an efficient nonprofit personnel service—are available upon request. The same rule for payment of fees applies to registrants who advertise in these columns. All replies should be addressed to the key numbers indicated and mailed to the New York Office. Please enclose six cents in postage to cover cost of mailing and return of application. A weekly bulletin of engineering positions open is available to members of the cooperating societies at a subscription rate of $3.50 per quarter or $12 per annum, payable in advance.

ENGINEERS. (*a*) Construction Engineer, degree, and at least 10 years' construction experience on municipal public works project or equivalent qualifications. Must be capable of handling all construction details in connection with municipal projects, such as street paving, sewer line and water line installation, etc. Starting salary, $4,690 a year. (*b*) Engineers with some experience in municipal work, qualified to do field work, as well as office work. Starting salary, $3,720 a year. Replies should state qualifications. Location, South. Y-1222.

JOB ENGINEER. Must have had experience in heavy concrete water front construction, i.e., piers and graving docks. This experience nec[essary]. Salary, $7,800–$8,400 a year, plus liv[ing] allowance. Location, Mexico. Y-1225.

JUNIOR HYDRAULIC ENGINEER, B.S. degree [in] civil engineering (hydraulics). A graduate in the general field of engineering science or in geolo[gy] or other allied field with specialized training [in] meteorology could qualify; a graduate with major or minor in hydrology would also quali[fy]. Should preferably be resident of Pennsylvan[ia]. Salary, $3,200 a year. Y-1227.

SANITARY ENGINEERS on the staffs of [field] parties in Uruguay, Brazil, Colombia and Par[a]guay. Salaries: $5,905 a year in Brazil a[nd] Colombia; $7,102 a year in Uruguay and Par[a]guay, plus living allowances. Y-1240.

TEACHING PERSONNEL in civil engineer[ing]. (*a*) Instructors. Salaries, $3,000 a year. [(*b*)] Assistant Professors, M.S. degrees in civil eng[i]neering, with two years' college teaching, en[gi]neering subjects. Salary, $3,600 a year. [(*c*)] Associate Professor, M.S. degree in civil en[gi]neering, with 5 years' college teaching, en[gi]neering subjects, and one year academic respon[si]bility and professional responsibility. Sal[ary], $4,500 a year. Positions start September [...] 1948. Location, Michigan. Y-1248D.

CIVIL ENGINEER, preferably 28–45, for city [of] 50,000 population, municipal experience des[ir]able, primary function as assistant city engine[er]. Salary, $3,600–$5,000, depending on qualifica[tions]. Location, Colorado. Y-1254S.

TEACHING PERSONNEL. (*a*) Associate Profes[s]sor in Sanitary Engineering, master's degree [...]

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ired, doctorate preferred. Responsible charge all courses in hydraulics, hydrology, and saniry engineering; teach both undergraduate and aduate work; direct research. Salary, $4,200 r nine months. (b) Assistant or Associate ofessor in Structural Engineering, master's egree required, doctorate preferred. Profesnal practice and teaching experience desired, teach undergraduate structural courses and boratory work in materials testing. Salary 3,800-$4,000 for 9 months, depending on exerience. (c) Instructor, master's degree dered, with minimum of 2 years' teaching and prossional experience to teach materials testing d or soil laboratory courses; some surveying ork. Salary, $2,800-$3,000 for nine months. ocation, North Carolina. Y-1276.

Engineers. (a) Sanitary Engineers experinced in water supply, sewerage, reports and inestigations, capable of carrying out work with ly general supervision, and capable of preparg the writing of sanitary reports. Should have irect experience in this field and general knowldge of municipal utilities. Salary open, dependg upon experience. (b) Structural Designers apable of layout design, detailing or reinforced oncrete, sanitary water supply structures. Exerience in this field preferable, but will consider ecent graduates having structural option or ajor. Work begins September 1948. Salary pen, depending upon experience. Location, aryland. Y-1305.

Civil Engineer with some editorial and writg experience and with considerable experience n residential construction, to write and edit a eries of articles on materials, appliances and quipment in modern homes. Salary, $8,000–10,000 a year. Location, New York, Y-1309.

Editorial Assistant, preferably civil gradute, interested in editorial writing. Will review chnical papers, style articles and write editorials r technical journal on building materials. Salry, $3,500-$5,000 a year. Location, Michigan. Y-1317D.

Teaching Personnel in civil engineering.) Instructors. Salaries, $2,700 for 9 months ith the possibility of working in summer school r an additional $540. (b) Associate Professor, aster's degree. Opportunity for advancement o head of department. Salary, $4,000-$4,500 r 9 months. Location, New Mexico. Y-1328.

(Continued from page 88)

Jones, William Robert (Jun. '39; Assoc. M. '48) Resident Engr., Dept. of the Army, Corps. of Engrs., Baltimore Dist., P.O. Box 417, Sunbury, Pa.

Kennett, Thomas Charles (Jun. '40; Assoc. M. '48) Cons. Supt., James Stewart & Co. Inc., P.O. Box 6603 (Res., 5725 Newholme Ave.), Baltimore 6, Md.

Klein, Francis Burt (Jun. '35; Assoc. M. '48) Design Engr., Donald R. Warren Engrs., 500 South Figueroa (Res., 9625¹/₂ South Hoover), Los Angeles 44, Calif.

Kliner, Walter Joseph Frank (Jun. '40; Assoc. M. '48) 4916 Spring Rd., Oaklawn, Ill.

Mason, William Ralph (Jun. '40; Assoc. M. '48) Instr., Univ. of Washington, More Hall, Seattle, Wash.

Mathes, Ellis LeRoy (Jun. '39; Assoc. M. '48) Traffic Engr., State Bureau of Highways, State House (Res., 1607 Broadway), Boise, Idaho.

May, Arnold Nicholas (Jun. '42; Assoc. M. '48) Cons. Engr., China Relief Mission, Care, American Consulate Gen., A.P.O. 917, Care, Postmaster, San Francisco, Calif.

Moore, Ernest Arthur (Assoc. M. '35; M. '48) Hydr. Engr., Sugar Manufacturers' Assn., Sugar Research Dept., 134 Hope Rd. (Res., 194 Mountain View Ave.), Liguanea, P.O., Jamaica, B.W.I.

Moy, Harland Frederick (Jun. '44; Assoc. M. '48) Asst. Engr., Spokane, Portland & Seattle Ry., 1101 North West Hoyt St. (Res., 5347 North East 35th Ave.), Portland, Ore.

Oakey, John Arthur (Assoc. M. '36; M. '48) Chairman, Civ. Eng. Dept., N.Dak. Agr. College, Fargo, N.Dak.

Pack, John George, Jr. (Jun. '32; Assoc. M. '44; M. '48) Principal Engr., Corps of Engrs. Office of Div. Engr., North Atlantic Div., Dept. of the Army, 111 East 16th St., New York, N.Y. (Res., 52 Dexter Rd., Southport, Conn.)

Raleigh, John Clark (Jun. '36; Assoc. M. '48) 1363 West Twenty-sixth St., San Pedro, Calif.

Simpson, Robert Edward (Jun. '39; Assoc. M. '48) Materials Engr. (P-3), Care, Public Roads Administration, Box 391, Ogden, Utah.

Smith, Adrian Woodrow (Jun. '36; Assoc. M. '48) Engr., Boiler Feedwater, Utilities Branch, Headquarters Sixth Army (Res., 2011 Thirty-second Ave.), San Francisco, Calif.

Sparks, Robert Earl (Jun. '38; Assoc. M. '48) Lt. Comdr. (CEC), U.S. Navy, Staff Comservpac, Box 34, Fleet Post Office, San Francisco, Calif.

Starr, Mark Elwood (Jun. '37; Assoc. M. '48) Professional Engr., South Market St., Selinsgrove, Pa.

Sturdy, Howard Henry (Jun. '36; Assoc. M. '48) Gen. Mgr., Cont. Div., Dravo Corp., Neville Island, Pittsburgh, Pa.

Sturges, Frank Caleb (Assoc. M. '40; M. '48) Vice-Pres. and Gen. Mgr., Pennsylvania Drilling Co., 1205 Chartiers Ave., Pittsburgh 20, Pa.

Thomas, Mark Everett (Jun. '26; Assoc. M. '37; M. '48) Cons. Civ. Engr., Mark Thomas & Co., 18 North San Pedro St., San Jose 11, Calif.

Tourtellot, Irving Williams (Jun. '37; Assoc. M. '48) Engr. in charge, Constr., Crandall Dry Dock Engrs., Inc., 238 Main St., Cambridge 42, Mass.

Weisman, Robert Leon (Jun. '44; Assoc. M. '48) Engr., Turpin Wachter & Associates, 803 Cathedral St. (Res., 3410 Du Pont Ave.), Baltimore 15, Md.

Wilkie, Charles Baldwin (Assoc. M. '41; M. '48) Project Engr., The H. K. Ferguson Co., 39 Broadway, New York 6, N.Y.

Williams, Belmont Murray (Jun. '34; Assoc. M. '48) 799 Albany St., Schenectady 7, N.Y.

Williams, Stephen Asa (Jun. '37; Assoc. M. '48) Civ. Engr., St. Louis Dist. Corps of Engrs., Service Base, Foot of Arsenal St., St. Louis (Res., Route 1, Robertson), Mo.

Young, David (Jun. '37; Assoc. M. '48) David Young—Builder, 782 South Coast Blvd., Laguna Beach, Calif.

Reinstatements

Aass, Asbjorn Hjalmar, M., Civ. Engr., Ingeniorene Sigurd Lund & Asbjorn Aass, St. Olavsgt 21 c, Oslo (Res., General Krohgsvei 7, Smestad), Norway, readmitted June 7, 1948.

Browning, Glen Earl, Jun., Public Health Engr. Trainee, State Board of Health, 1022 South West Eleventh St., Portland, Ore. (Res., 1449 West 69th St., Los Angeles 44, Calif.), reinstated July 12, 1948.

Byrnes, Garrett Joseph, M., Executive Officer, Corps of Engrs., Fort Norfolk, P.O. Box 119, Norfolk 1, Va., readmitted June 7, 1948.

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EKMAN, CLAES THEODORE, Assoc. M., Director, Div. of Water Resources, Room 8, State Office Bldg., St. Paul, Minn., reinstated July 28, 1948.

GREEN, EARL, Assoc. M., Asst. Highway Engr., State Highway Dept., 247 Third St., San Bernardino, Calif., reinstated July 28, 1948.

GWYTHER, M. W. VAL., M., Resident Engr., H. A. Simons Consulting Engr., 807 Holden Bldg. (Res., 3255 West 3rd Ave.), Vancouver, B.C., Canada, readmitted June 7, 1948.

PALMORE, HOVEY DUNCAN, M., Care, Kentucky Concrete Pipe Co., Box 126, Frankfort, Ky., reinstated July 22, 1948.

RUPP, VERNON WARD, Assoc. M., Regional Hydr. Engr., Care, U.S. Weather Bureau, Los Angeles, Calif., reinstated July 2, 1948.

SHERIDAN, EMMETT HUGH, Assoc. M., Lt. Comdr., U.S. Coast & Geodetic Survey, 705 Federal Office Bldg., Seattle, Wash., reinstated July 28, 1948.

WALSH, JOHN BURKE, Jun., 5227 Arlington Ave., New York 63, N.Y., reinstated July 14, 1948.

Resignations

BONNELL, RALPH ARNOLD, SR., M., The Whitehall, 105 East Delaware Place, Chicago 11, Ill., resigned July 20, 1948.

DALE, EVERETT ELDRIDGE, JR., Jun., Care, Austin Bridge Co., P.O. Box 1500, Dallas, Tex., resigned July 7, 1948.

GOFF, WAYNE LEROY, Assoc. M., Lt. Comdr., U.S. Coast Guard; 34 Estrella Ave., Piedmont 11, Calif., resigned July 20, 1948.

HILDABRAND, THEODORE JOSEPH, Jun., Eureka, Calif., resigned July 20, 1948.

LUCAS, CHESTER LAURICE, Jun., 2333 Memorial Ave., S.W., Roanoke, Va., resigned June 15, 1948.

MANN, ROBERT LIVINGSTONE, Jun., 603½ Madison St., Jefferson City, Mo., resigned July 2, 1948.

MOORE, ROBERT SCOTT, Jun., 1833 Carey Place, Oklahoma City 6, Okla., resigned July 9, 1948.

SAVAGE, RICHARD EWART, Assoc. M., Route 4, Box 198, Sebastopol, Calif., resigned July 20, 1948.

APPLICATIONS FOR ADMISSION OR TRANSFER

September 1, 1948 Number 9

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every Member is urged, therefore, to scan carefully the list of candidates published each month in CIVIL ENGINEERING *and to furnish the Board with data which may aid it in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know the applicant personally as well as upon the nature and extent of his professional experience. Any facts derogatory to the personal character or professional reputation of an applicant should be promptly communicated to the Board. Communications relating to applicants are considered strictly confidential.

The Board of Direction will not consider the applications herein contained from residents of North America until the expiration of 30 days, and from non-residents of North America until the expiration of 90 days from the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

Grade	General Requirement	Age	Length of Active Practice	Responsible Charge of Work
Member	Qualified to design as well as to direct important work	35 years	12 years	5 years
Associate Member	Qualified to direct work	27 years	8 years	1 year
Junior	Qualified for subprofessional work	20 years	4 years	
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years	5 years

APPLYING FOR MEMBER

BELL, KENNETH SIDNEY (Age 42) Mgr., Anglo-Portuguese Constr Co., Lisbon, Portugal; Surbiton, Surrey, England, 22 Elmcroft Drive; temporary address, The Engineers Club, 32 West 40th St., New York City.

BUHRENDORF, JOHN CHRISTOPHER (Age 60) Senior Div. Engr., Western Dept. Executive, New York City Board of Water Supply, Shavertown, N.Y.

DEGEN, GERALD DU BOIS (Age 39) Project Engr., Inst. Nacional Sanitary Works, Venezuelan Govt., Barcelona, Estado Anzoatequi, Venezuela.

FERRANDON, JEAN (Age 39) Director, Service d'Etudes de la Societe Anonyme Ossude, Paris, France.

GUMENSKY, DMITRY BENJAMIN (Assoc. M.) (Age 50) Chf. Designing Engr., National Hydroelectric Eng. Bureau of China, Nanking, China.

GUTTRIDGE, IRVING WENTWORTH (Age 47) Civ. Engr., Senior Sec. Engr., Western Dept., New York City Board of Water Supply, Downsville, N.Y.

HORD, THOMAS ALAN (Age 59) Design and Specification Engr., Dallas, Tex.

JONES, ALBERT WILLIAM (Assoc. M.) (Age 41) Highway Bridge Engr., U.S. PRA, Cochabamba, Bolivia.

KNIGHT, HARRY ROBERT (Age 66) Designing Engr. with Myron A. Sturgeon, Norfolk, Va.

KRUSER, ROSS WELLS (Age 41) Engr. Asst. to Deputy Commr., Finance and Business Management, PRA, Washington, D.C.

LEWIS, HAROLD HARDIN (Age 52), Chf. Design Engr., in charge of Eng. Div., Municipal Light & Power Dept., Pasadena, Calif.

LIER, ARNE (Age 48) Structural Engr., The Port of New York Authority, New York City.

MCCONNELL, WILLIAM MCCLURE (Age 37) Engr. Partner, J. L. McConnell & Associates, Chicago, Ill.

MANNES, CONRAD OLAI (Age 62) Engr., DeWitt C. Griffin & Associates, Seattle, Wash.

MORTENSON, PETER, JR. (Age 50) Chf. Structural Engr., H. E. Beyster Corp., Archts. and Engrs., Detroit, Mich.

NEEL, MERVILLE CHARLES (Assoc. M.) (Age 50) Chf. Engr., Rilco Laminated Products, Inc., St. Paul, Minn.

OSSUDE, FRANCOIS (Age 38) Gen. Mgr., Enterprisees Ossude & Blanc, Ste. Francaise De Dragage et Deroctage and Societe Anonyme Ossude; Pres. and Gen. Mgr., Societe Algerienne De Travaux Publics De L'Afrique Du Nord & Alger, St. Cloud, Seine-et-Oise, France.

PROUT, PAUL JUDD (Assoc. M.) (Age 35) Cons. Engr. (private practice), Long Beach, Calif.

RHODES, ARNOLD EDWARD (Age 54) Engr., Works Dept., New Zealand Govt., Auckland, N.Z.

RICHARDS, PAUL WEIR (Age 37) San. Engr., Corps of Engr., War Dept., U.S. Army, East Point, Ga.

SCIMEMI, ETTORE (Age 52) Prof. and Head of Hydr. Sec., Univ. of Padova, Padova, Italy.

SOUCEK, JAROMIR JAN (Assoc. M.) (Age 47) Prof. of Highway Eng., Benes Tech. Univ., Brno, Czechoslovakia.

STANKIEWICZ, EUGENE JOSEPH (Age 34) Structural Engr., Sargent & Lundy, Chicago, Ill.

THOMAS, WESLEY COURTLAND (Age 62) Div. Engr., New York City Board of Water Supply, Downsville, N.Y.

VAUGHAN, EVAN WILLIAM (Assoc. M.) (Age 40) Associate Prof. of Civ. Eng., Syracuse Univ., Syracuse, N.Y.

APPLYING FOR ASSOCIATE MEMBER

AHROL, KENNETH WOODROW (Age 35), Chf. Engr., Eng. and Design Sec., PWD, U.S. Naval Operating Base, Roosevelt Roads, Puerto Rico.

BARRETT, WILLIAM SCOTT (Jun.) (Age 34) Engr. II, Eng. Dept., Burbank, Calif.

BLAKE, WARNER PAUL (Jun.) (Age 34) Asst. Engr., Minneapolis Gas Light Co., Minneapolis, Minn.; Hopkins, Minn.

BONIN, CHARLES CLEMENS (Age 31), Civ. Engr., Ebasco Services, Inc., New York City; 2 Rector St., Atlantic Highlands, N.J.

BROWN, IRVING LYNN (Jun.) (Age 34) Engr. (Partner), Brown & Brown, Archts. and Engrs., Dallas, Tex.

COTRIM, JOHN REGINALD (Jun.) (Age 33) Asst. Hydr. Engr., Cia Auxiliar de Empresas Eletr. Brasileiras (Brazilian Br., Ebasco International Corp., New York), Rio de Janeiro, Brazil.

CROCKETT, VERNON PREUIT (Age 34) Cons. Engr. (private practice), Vernon P. Crockett, Engrs., Sheffield, Ala.

CURREN, VINCENT JOSEPH (Age 41) Asst. Civ. Engr., New York City Board of Water Supply, Downsville, N.Y.

DEMERS, ROMEO EDOUARD (Age 51), City Supt. Engr., Levis, Que., Canada.

DIENHART, ARTHUR VINCENT (Jun.) (Age 29) Asst. to Gen. Supt. of Constr., Northern States Power Co., Minneapolis, Minn.

DIER, CLIFFORD LAURENCE (Age 44), Secy.-Treas., Harold Hoskins & Associates, Inc., Lincoln, Nebr.

DUNCAN, ROBERT MITCHELL (Age 40) Designer, Detailer, Sverdrup & Parcel, Inc., San Francisco, Calif.

FISCELLA, BENJAMIN JOSEPH (Age 29) Engr., New York City Board of Water Supply, Bronx, N.Y.

FOLEY, ELZEAR ROCHUS (Age 37), Senior Bridge Engr., State Bridge Dept., California; San Leandro, Calif.

FREELAND, THOMAS HENRY (Age 46) Res. Engr., Bureau of Reclamation, U.S. Dept. of Interior, Needles, Calif.

FUQUAY, GARTH ARCHIE (Jun.) (Age 31) Engr. (Soils Mechanics) P-3, So. Pacific Div., Corps of Engrs., U.S. Army, Los Angeles, Calif.

GERWICK, BEN CLIFFORD, JR. (Age 29) Vice-Pres., Ben C. Gerwick, Inc., San Francisco, Calif.

GRAHAM, LESLIE WALLACE (Jun.) (Age 34) Associated member of firm, W. Adrian & Associates, San Francisco, Calif.

GREGORY, KENNETH (Age 34) Engr., Bigelow Liptak Corp., Detroit, Mich.

GUSTAFSON, RICHARD FRANKLIN (Age 48) Civ. Engr., Light Div., Dept. of Public Utilities, Tacoma, Wash.

HARRIS, FREDERICK ARTHUR (Jun.) (Age 35) Sr. Engr., Houston Urban Expressways, Texas Highway Dept., Houston, Tex.

HARRIS, MARK PICKETT (Age 41), Asst. Prof. of Eng. Drawing and Mechanics, Georgia Inst. of Technology, Atlanta, Ga.

HEAD, JAMES ALBERT (Jun.) (Age 34) Asst. Traffic Engr., Oregon Highway Dept., Salem, Ore.

HIATT, WRIGHT (Jun.) (Age 33) Lt. Col. U.S. Air Force, Ft. Belvoir, Va.

(Continued on page 98)

(Continued from page 94)

HUNTER, HARRY WARREN DEMAREST (Age 26) Asst. to Dist. Mgr., Raymond Concrete Pile Co., Detroit, Mich.

HURSH, ROBERT SMITH (Age 39) Instructor, summer session, Civ. Eng. Dept., Wayne Univ., Detroit, Mich.

HURTLEY, WALTER ALEXANDER (Jun.) (Age 33) Jun. Civ. Engr., City of Duluth, Minn.

JACKSON, ROBERT SHOEMAKER, JR. (Age 36) Project Engr., DUG, MANED, Clark Field, Philippine Islands; Rochester, N.Y.

JUHRE, CHARLES CARR (Age 40) Topographic Engr. P-4, U.S. Geological Survey, Washington, D.C.

LARSON, FLOYD CLIFFORD (Age 39), Asst. Prof., Virginia Poly. Inst., Blacksburg, Va.

LEPARSKI, WITOLD (Age 33) Archt. (private practice), 5 Route Cohen, Shanghai, China.

MACFARLANE, ROBERT BRUCE (Age 52), Member of firm, Macfarlane and Associates, Archts. and Engrs., Richmond, Va.

MAIALE, ANTHONY JOSEPH (Jun.) (Age 35) Engr., Merritt, Chapman & Scott Co., Wilmington, Del.

MINKLER, ALBEN PAGE (Age 41) Civ. Engr. P-5, Puget Sound Naval Shipyard, Bremerton, Wash.

PAGE, HAROLD LONGHURST (Age 44) Associate Civ. Engr., Div. of Water Resources, Sacramento, Calif.

PICHLER, ERNESTO (Age 45) Asst. Engr., Dept. of Soil Mechanics and Foundations, Escola Politecnica da Universidade de São Paulo, São Paulo, Brazil.

POTTER, WILLIAM CURTIS (Age 38) Student, Carnegie Inst. of Technology, Pittsburgh, Pa.; with Pan-American Airways. Formerly with U.S. Navy.

RAYMOND, HENRY SHERRICK (Jun.) (Age 35) Dist. Engr., Maricopa County Municipal Water Conservation Dist., No. 1, Peoria, Ariz.

RICE, PERRY DAVIS (Age 40) Civ. Engr. II, TVA, Norris, Tenn.

RICHARDSON, JAMES ARTHUR, JR. (Jun.) (Age 34) Engr. P-3, Dept. of Army, Corps of Engrs., Los Angeles, Calif.

RUSS, WALTER (Age 46) Designer A and Asst. Squad Leader, Pacific Gas & Elec. Co., Public Utilities, San Francisco, Calif.

SARKAR, NIRMAL KUMAR (Age 35) With Messrs. Braithwaite & Co. (India), Ltd., Calcutta, India.

SHOCKLEY, WOODLAND GRAY (Jun.) (Age 34) Engr., Waterways Experiment Station, Asst. Chf. Embankment and Foundation Branch, Vicksburg, Miss.

SIEMER, HERBERT H. (Age 41) With New York City Board of Water Supply, on construction of Delaware Aqueduct, Stone Ridge, N.Y.

SILBERMAN, EDWARD (Jun.) (Age 34) Research Associate (equivalent of Asst. Prof.), St. Anthony Falls Laboratory, Univ. of Minnesota, Minneapolis, Minn.

SMITH, THOMAS SHERBURNE, JR. (Jun.) (Age 29) Asst. County Engr., Escambia County, Brewton, Ala.

TANDLER, HERBERT KURT (Age 36), Member of firm, H. K. Tandler and S. Herz, Chartered Structural Engrs., Johannesburg, So. Africa.

TRACY, NELLSON NICHOLSON, JR. (Age 30) Res. Engr., J. E. Sirrine Co., Roanoke Rapids, N.C.

UMAR, CHAUDARI MOHAMMAD (Age 28) Engr., Govt. of Pakistan, on study in United States, Washington, D.C.

WOHLT, PAUL EDWARD, (Jun.) (Age 34) Engr. (Soil Mechanics), P-4, Head, Soils Sec. Missouri River Div. Central Laboratory, Corps of Engrs., Omaha, Nebr.

APPLYING FOR JUNIOR

BLOMQUIST, GAIL CHARLES (Age 30) Asst. Prof. of Civ. Eng., Michigan State Coll., East Lansing, Mich.

CHI, CHIN-JUI (Age 23) Graduate Student, Georgia School of Technology, Atlanta, Ga.

GITTINS, ROBERT BRUCE (Age 23) Office Engr. and Estimator, George Pollock Constr. Co., Sacramento, Calif.

LEONARD, HARRY JACK (Age 24), Asst. Engr., Edwards & Kelcey, Cons. Engrs., New York City.

LONDE, PIERRE GEORGES LEON (Age 25) Training with U.S. Bureau of Reclamation, Dam Design and Earth Laboratories, Denver, Colo.; permanent address, Courbevoie, France.

MICHEL, MAX AUGUSTE (Age 26) In Training, U.S. Bureau of Reclamation, Denver, Colo.

MOLLER, BORGE (Age 31) Civ. Engr., São Paulo Tramway Light and Power Company, Ltd., São Paulo, Brazil.

MONTAGNE, PAUL ANDRE (Age 26) In training with Bureau of Reclamation, Concrete Laboratories, Denver, Colo.

REED, CHARLES PALMER (Age 31) Cartographic Engr., Dept. of Commerce, U.S. Coast & Geodetic Survey, Washington, D.C.

REINHART, ARTHUR SULLIVAN (Age 28) Engr. P-2 (Hydr.), U.S. Bureau of Reclamation, Denver, Colo.

RETTIG, REIMER ALBERT (Age 24) Designer, Stone & Webster Eng. Corp., Edgewood, R.I.

RICE, RICHARD SHERMAN (Age 25) Structural Designer, Clarkson & Moreland, Cons. Engrs., Boston, Mass.

TINNEY, EDWY ROY (Age 23) 1947 B.A. Sc., Univ. of British Columbia; graduate student, Univ. of Washington, Seattle, Wash.

WU, GEORGE SHAOCHIH (Age 26) Graduate student, Civ. Eng. Dept., Univ. of California, Berkeley, Calif.

UNIV. OF ALA.	AGE
SIPE, CHARLES ALLEN, JR., 1947	(25)

UNIV. OF ARIZ.	
CUTLER, ALBERT B., JR., 1948	(27)
OXLEY, JAMES PAUL, JR., 1948	(24)

BROOKLYN POLY. INST.	
PAINTER, ERNEST WALTER, JR., 1948	(24)

BROWN UNIV.	
HAZARD, FREDERICK ROWLAND, III, 1948	(25)

BUCKNELL UNIV.	
TRACY, DONALD JEROME, 1948	(25)

UNIV. OF CALIF.	
ABRAMSON, MARTIN, 1948	(24)
ADAMS, ORIN RUSSELL, 1948	(29)
ALVES, FRANCIS RUSSELL, 1948	(22)
ALZUETA, CARLOS CASTAN, 1948	(24)
AUBERY, MELVILLE WESTON FULLER, 1948	(25)
BABCOCK, HAROLD EDWARD, 1948	(21)
BALCOM, KENNETH GUSTAVE, 1948	(28)
BASYE, ROBERT ALLEN, 1948	(24)
BEAUMONT, KLYNG GEORGE, 1948	(27)
BERGER, AUGUSTUS BART, 1948	(24)
BOISVERT, CLAYTON CLARENCE, 1948	(26)
BOND, ROBERT BAKER, 1948	(29)
BURGAN, RAYMOND WILEY, JR., 1948	(25)
CHANEY, RICHARD WORKS, 1948	(28)
CHAMBERLIN, DONALD DEHORACE, 1948	(24)
CLAUSEN, WALTER BERTIN, JR., 1948	(27)
CLEMENS, MORRIN OSCAR, 1948	(28)
COLE, IRVING ROBERT, 1948	(22)
COOLIDGE, JAMES DOUGLAS, 1948	(25)
CUNLIFFE, HEBER JOHN, 1948	(26)
DIXON, ROY EDWARD, 1948	(27)
FINSTER, EDWIN HOY, 1948	(24)
FISHER, PETER WILLARD, 1948	(21)
FONG, HAYWARD, 1948	(23)
FOSTER, JOHN DOUGLASS, 1948	(28)
FRASER, BRUCE LOVAT, 1948	(24)
GAHN, CHESTER JULIO, 1948	(26)
GOLDMAN, ANATHOL, 1948	(27)
GULICK, CHARLES WARD, JR., 1948	(21)
GUPTILL, JOSEPH CRYER, 1948	(25)
HALL, DAVID MICHAEL, 1948	(23)
HARDER, ORRIN HOWARD, 1948	(26)
HOLMES, LEROY ERNEST, 1948	(29)
KAHN, EDWIN WALTER, 1948	(26)
KALICHMAN, SAMUEL GEORGE, 1948	(27)
KERSNAR, FRANK JOSEPH, 1948	(28)
KOHNO, FRED, 1948	(27)
LANE, PAUL HENRY, 1948	(26)
LARSEN, HARRY EARNEST, 1947	(31)
LEE, JEFFREY, 1948	(25)
LEE, ROBERT, 1948	(26)
LEFEVRE, WILLIAM WAYNE, 1948	(32)
LEIPZIG, ALFRED DANIEL, 1948	(26)
LINDGREN, CHARLES ALBERT, JR., 1948	(24)
MCCULLOUGH, CHARLES ALBERT, 1948	(27)
MCDONALD, JACK HERBERT, 1948	(24)
MCDOWELL, JAMES MARTIN, 1948	(24)
MAHONY, DONALD GLENN, 1948	(24)
MARTIN, DOUGLAS, 1948	(25)
MATSON, GILBERT JUNIOR, 1948	(25)
MEYER, EDWARD HERBERT, 1948	(24)
MORAN, CHARLES FRANCIS, 1948	(27)
MYRON, GEORGE CLARKE, 1948	(28)
NIELSEN, HUBERT LIONEL, 1948	(27)
PAUL, ROBERT MORGAN, 1948	(24)
PENPRASE, DONALD, 1948	(22)
PETERSON, CLARENCE CALVIN, 1948	(25)
PHILLIPS, EDWARD EUGENE, 1948	(22)
PICKELL, JAMES JOSEPH, 1948	(21)
RIFFLE, FRANKLIN ANDERSON, 1948	(29)
RIGGS, LOUIS WILLIAM, JR., 1948	(26)
RODDEN, WILLIAM PATRICK, 1947	(20)
RUSTICI, RUSSELL LEONARD, 1948	(24)
SAWYER, FREDERICK HELLMANN, 1948	(30)
SCHENCK, ROBERT WOODHALL, 1948	(28)
SEBRING, ROBERT GENE, 1948	(25)
SELMI, DOMINIC JOHN, 1948	(24)
SPAULDING, LINN STOWELL, 1948	(26)
TALT, DANIEL HENRY, JR., 1947	(28)
TRONOFF, THEODORE VERNON, JR., 1948	(23)
VIRGIL, PHILIP SPENCER, JR., 1948	(28)
WALTHEN, JAMES ALEXANDER, JR., 1948	(25)
WOLF, MARVIN JOSEPH, 1948	(24)
YEAGER, ERNEST EUGENE, 1948	(23)

	Age
ZACHER, EDWIN GRIFFITH, 1948	(28)

CASE INST. OF TECH.

ATHERTON, NEIL PIERCE, 1948 (24)

CATHOLIC UNIV.

PONTON, PAUL EVANS, 1948 (23)
SULLIVAN, JAMES BERNARD, JR., 1948 (24)

CLARKSON COLL. OF TECH.

MORROW, ROBERT LOUIS, 1948 (27)

CLEMSON COLL.

MORRIS, THOMAS ROLAND, JR., 1948 (26)
PERRIN, NEILL MACAULAY, 1948 (23)

COLO. A. & M. COLL. — Age

JOSEPH, KENNETH VESTER, 1948 (26)
COREY, GILBERT LEE, 1948 (25)

COLUMBIA UNIV.

BREAKSTONE, ARTHUR LEONARD, 1948 (22)
COOPER, SOL E., 1948 (27)
JOHNS, GERALD HOWARD, 1948 (30)
SOBEL, STANLEY ROBERT, 1948 (23)
WEBER, ROBERT DAVIS, 1948 (26)

UNIV. OF CONN.

MELLEN, CURTIS GORDON, 1948 (25)
OLSHESKY, JOHN JAMES, 1947 (33)

CORNELL UNIV. — Age

BARR, PETER NATHANIEL, 1948 (27)
NORTH, WILLIAM LEE, 1948 (28)
SCOTT, JAMES WILLIAM, 1948 (27)
SHUTE, LESLIE VINCENT, 1948 (28)

DARTMOUTH COLL.

AYERS, BENJAMIN KIMBALL, JR., 1948 (22)

UNIV. OF FLA.

BIRDSALL, ROBERT JACOB, 1948 (25)
LAWSON, HORACE FAY, JR., 1948 (24)
STEELE, DONALD FRANKLIN, 1948 (26)
SWEAT, JAMES PASCO, 1948 (27)
UGARTE, CARLOS AMOR, 1948 (29)

GEORGE WASHINGTON UNIV.

JEWELL, FREMONT HENRY, 1948 (30)
SHAW, RICHARD EARL, 1948 (26)

GA. SCHOOL TECH.

MCCABE, JOSEPH MONTEITH, JR., 1948 (26)

HARVARD UNIV.

HUSAIN, SYED IRSHAD, 1948 (23)
ISMAILI, ABDUL MOHAMMAD, 1948 (21)
VARCHESE, PUTHENVEETIL CHANDAPILLA, 1948 (27)

UNIV. OF IDAHO

DUNN, THOMAS MONROE, 1948 (30)

ILL. INST. TECH.

BAER, RUBEN JULES, 1948 (21)
COLEMAN, GEORGE, 1948 (25)
KOEHLER, ALEXANDER CHARLES, 1948 (30)
KUHN, ARTHUR HENRY, JR., 1948 (28)
KUSTON, LEROY ALFRED, 1948 (26)
MINWEGEN, PETER ARTHUR, 1948 (24)
NIEMCZYK, MICHAEL VALENTINE, 1948 (26)
SCHAFFER, SHERWIN, 1948 (27)
SPONSELLER, WILLIAM JOHN, 1948 (22)
WYNNE, STEPHEN MAX, 1948 (27)

UNIV. OF ILL.

GRIMBLE, LOUIS GEORGE, 1948 (28)
LI, RICHARD I-HUA, 1948 (22)

IOWA STATE COLL.

BECK, RICHARD FREDERICK, 1948 (25)
DANKBAR, ROMAN LEONARD, 1948 (26)
DRESSELHOUSE, DONALD EUGENE, 1948 (22)
FERREE, CARMAN MYERS, 1948 (22)
FRENCH, DONALD ERNEST, 1948 (26)
O'CONNOR, EDWARD JOSEPH, 1948 (27)
OFFENBECHER, EUGENE RAYMOND, 1948 (22)
PEDERSEN, FREDERICK EDWARD, II, 1948 (25)
SPENCER, EARL SHAVER, 1948 (24)
SWANSON, VERNON EDWARD, 1948 (24)

UNIV. OF IOWA

BELL, ROBERT THOMAS, 1947 (23)
ELLSWORTH, WILLIAM MARTIN, JR., 1947 (26)

JOHNS HOPKINS UNIV.

KLINGENMEIER, RUSSELL JOHN, JR., 1948 (26)
LINK, FREDERICK WILLIAM, JR., 1948 (22)
RASCH, WILLIAM GUSTAV, II, 1948 (27)
SCHMUCKER, EDWIN SIMON, JR., 1948 (25)

UNIV. OF KANSAS

BANKS, PAUL IRVING, 1948 (26)
BRUCE, JAMES ROLLIN, 1948 (22)
BURRIS, NORWIN JACK, 1948 (26)
CASE, LOWELL CLYDE, 1948 (25)
CHITTY, CHARLES EDWARD, 1948 (24)
CHURCH, HUBERT MILESS, 1948 (25)
COLMAN, CLARE J., 1948 (25)
DAILY, JACK FREDERICK, 1948 (28)
FRYE, ELDON CLIFFORD, 1948 (26)
HALL, WILLIAM JOEL, 1948 (22)
KENDREE, JACK MCLEAN, 1948 (22)
LANYON, PHILLIP DELOSE, 1948 (29)
LASLEY, JACK MOSS, 1948 (23)
LEE, ROGER DALE, 1948 (25)
MEREDITH, ROBERT ARTHUR, 1948 (27)
NACCARATO, SIBIO, 1948 (27)
SEYBERT, LEE ALVIN, 1948 (28)
SHOCKLEY, CLYDE A., JR., 1948 (23)
SMITH, HAROLD COLBURN, 1948 (22)
STARK, PAUL WILLIAM, 1948 (21)
TOCH, ARTHUR, 1948 (26)
WIEDEMANN, ROBERT EUGENE, 1948 (26)

UNIV. OF KY.

CLARK, JOHN HALLETT, JR., 1947 (29)
CRAWFORD, JEAN GRAY, 1948 (24)
DRAKE, WILLIAM BRIGHT, 1948 (26)
FINNIE, WILLIAM HORACE, 1948 (25)
GILLIM, ROBERT MACK, 1948 (28)
GOFF, NATHAN INMAN, JR., 1948 (27)
HAYS, JOE, JR., 1948 (25)

K·E
PHOTACT
BLUE
TRACING CLOTH
30
K·E
CONTACT
PHOTACT
ALBANIZED
K·E
PHOTACT
DEVELOPER
5 GALLONS
K·E
PHOTACT
FIXER

LA. STATE UNIV.

BILLEAUD, MANNING FRANCIS, 1948
CALCOTE, ARLIE BRIGHT, JR., 1948

UNIV. OF ME.

FRIAR, CALVIN, 1948
GALIANO, FRANCIS JAMES, 1948
KNIGHT, STEPHEN CECIL, JR., 1948
SMITH, SHELDON DONALD, 1948
SOUTHARD, RICHARD CARTER, 1948

MANHATTAN COLL.

BONE, JEROME FRANCIS, 1948

MARQUETTE UNIV.

ADAMS, GUST ANTHONY, 1948
BREEST, NORMAN HARRY, 1948
DANBY, STEWART EDWARD, 1948
DEVINE, CHARLES CHARVE, 1948
ENGEL, EUGENE ISREAL, 1948
ENGLER, ALAN RAYMOND, 1948
KELLY, JOHN ALBERT, 1948
SCHMITZ, WALTER PAWLING, 1948
SHERBURNE, WILLIAM LE BOEUF, 1948

UNIV. OF MD.

HOBBS, JOHN ORWIG, 1948
RAYMOND, CHARLES BATCHELDER, 1948
RIDDLE, CHARLES HARVEY, JR., 1948

MASS. INST. OF TECH.

BLANCHARD, MURRAY EUGENE, 1948
BURDICK, JOHN LESTER, 1948
COLLINS, BUCKLEY, 1948
CRUCKSHANK, PAUL KENNETH, 1948
FARMER, HARLOW GROSVENOR, JR., 1948
McNEAR, DENMAN KITTREDGE, 1948

MICH. COLL. OF MIN. & TECH.

SMALLWOOD, JOHN PAUL, 1948

MICH. STATE COLL.

CHUCK, ROBERT TING, 1948

UNIV. OF MINN.

ANDERSON, DONALD GORDON, 1948
BURDSAL, THOMAS GALOW, 1948
CHRISTENSEN, MILTON ROGER, 1948
DUNN, ROBERT CARYL, 1948
HELLER, GEORGE WARREN, 1948
KENNING, ROBERT STANLEY, 1948
MALMER, RICHARD CLAIR, 1948
NELSON, JAMES CRAWFORD, 1948
PEDERSON, GLEN S., 1948
PURDY, JOHN GILBERT, 1948
ROLKE, WILLIAM, JR., 1948
SATROM, DONALD ROBERT, 1948
SCIPIO, LOUIS ALBERT, II, 1948
SHABATURA, EMIL ANTHONY, 1948
THOMAS, JERRY KAY, 1948
TSIVOGLOU, ERNEST CONSTANTINE, 1948
TRIPP, ROLAND ARTHUR, 1948
WHITE, HEWITT HERBERT, 1948

MISS. STATE COLL.

PRATT, KERN, JR., 1948

UNIV. OF MISS.

BRINSON, JOHN ROY, 1948

UNIV. OF MO.

FOSTER, ROGER MICHAEL, 1948
KING, THOMAS ARTHUR, 1948
MOORE, JOHN HENRY, 1948
MORRILL, GENEVIEVE THACHER ATWOOD, 1948

MONT. STATE COLL.

FACEY, JOHN KEN, 1948

UNIV. OF NEBR.

BECK, NORMAN EMIL, 1948
THEISEN, CASPER JOSEPH, 1948

UNIV. OF NEV.

MORRIS, JAMES MERVYN, JR., 1948

UNIV. OF N.MEX.

DAVIDSON, CHARLES WILMOTH, 1948
HALL, OMER DAVID, 1948
LAMPROSE, SOCRATES LEO, 1948
LEE, HANSEL ELNOR, 1948
PATTERSON, WILLIAM LEWIS, 1948
SANDOVAL, ALBERT, 1948
THORPE, ORLAND BARNWELL, JR., 1948
WINKLER, ROBERT LEWIS, 1948

COLL. OF CITY OF N.Y.

STEINMAN, HERBERT SEYMOUR, 1948

N.C. STATE COLL. — Age

…all, Jesse Griffin, III, 1948 (24)
…rown, Thomas Mack, 1948 (26)
…avis, Joel Henry, Jr., 1948 (22)
…eldman, Irving, 1948 (25)
…assell, Charles Clement, 1948 (23)
…arrish, Miley Randolph, 1948 (25)
…uppe, Charles Eddy, 1948 (21)
…aylor, James Harley, Jr., 1948 (27)
…agoner, Jack Robert, 1948 (24)

ORE. STATE COLL.

…utler, Clarence Edward, 1948 (30)
…avero, Louie, 1948 (27)
…atter, Vernon Emory, 1948 (33)
…yatt, William Westwood, 1948 (22)

PA. STATE COLL.

…ienko, Walter Joseph, 1948 (24)
…imperis, Thomas, 1948 (22)

UNIV. OF PA.

…rossan, Arthur Brook, 1948 (25)
…nsign, John Emil, 1948 (25)
…eidler, Leslie Lawrence, Jr., 1948 (22)
…artley, Boyd Alonzo, 1948 (23)
…hlmann, David Horace, Jr., 1948 (25)

UNIV. OF PITTSBURGH

…erto, Anthony Carmen, 1948 (27)
…antukhoff, Jacob Donald, 1948 (23)

PRINCETON UNIV.

…'Neil, Floyd Bert, 1948 (24)

PURDUE UNIV.

…lank, Robert Anton, 1948 (29)
…ord, Charles Harold, 1948 (24)
…orine, Harold Herbert, 1948 (22)
…lein, George Henry, 1948 (23)
…ellems, Thomas James, 1948 (26)

UNIV. OF SANTA CLARA

…allejas, Alfonso Eduardo, 1948 (24)

UNIV. OF SO. CALIF.

…llcock, Herman James, 1948 (28)
…ailey, Phillip Luman, 1948 (29)
…rinkmeyer, Norman Charles, 1948 (22)
…urgess, Burton Starr, Jr., 1948 (28)
…urnett, James George, 1948 (25)
…ush, Vincent Roy, 1948 (27)
…aldwell, Harold Linden, 1948 (24)
…hristensen, Jack Morgan, 1948 (24)
…lark, Walter Norman, 1948 (24)
…ulp, Robert Lee, 1948 (21)
Di Stefano, Vincent Valentino, 1948 (25)
…roats, Lorne, 1948 (26)
…allo, Victor Manuel, 1948 (31)
…owery, Donald Roy, 1948 (21)
…acobson, Robert Earl, 1948 (23)
…aharis, Jack Nikias, 1948 (24)
…elly, Kenneth Campbell, 1948 (23)
…ennedy, John Paul, 1948 (26)
…ramer, Joseph Dent, 1948 (24)
…ewis, William Joseph, 1948 (25)
…loyd, William Dennison, 1948 (22)
…lagenovich, William Martin, 1948 (24)
…ock, David John, 1948 (22)
…ollack, Sheldon Lew, 1948 (22)
…ollard, Robert Earl, 1948 (27)
…heffield, Myron Odell, 1948 (32)
…mith, Archie Albert, 1948 (29)
…mith, Daniel James, Jr., 1948 (34)
…peer, David Kenneth, 1948 (24)
…earda, Dean Tess, 1948 (24)
…einstein, Byron, 1948 (24)
…illiams, Richard Henry, 1948 (24)

SO. METHODIST UNIV.

…lexander, Willard Clay, 1948 (26)
McKinney, Ross Erwin, 1948 (22)
…tanovsky, Joseph Jerry, 1948 (20)

SYRACUSE UNIV.

…ill, John Albert, 1948 (26)

UNIV. OF TENN.

…orbis, William Max, Jr., 1948 (24)
…art, Edward Conrad, 1948 (27)
…ennon, James Carroll, 1948 (24)
McMurry, Charles Reid, 1948 (25)

TEX. A. & M. COLL.

…alcote, Lee Roy, 1948 (24)
…berhardt, Albert Lee, 1948 (27)
…ackebeil, Charles Ernest, 1948 (24)
…arvey Harold Edwin, 1948 (23)
…ughes, Ralph Condon, Jr., 1948 (20)
…lotz, Billy Wayne, 1948 (22)
…aguire, Lewis Simpson, 1948 (24)
…ewby, Jack Edward, 1948 (30)

	Age
Pate, John, 1948	(25)
Plangman, Jewell Frederick, Jr., 1948	(24)
Stieg, Edwin Lee, 1948	(25)
Wirsching, Joseph Edward, 1948	(21)

TEX. TECH. COLL.

Anderson, William Glenn, 1948 (29)

UNIV. OF N.DAK.

Olgeirson, John Webster, 1948 (32)

NORTHWESTERN UNIV.

Altmeyer, Robert Frederick, 1948 (27)
Blunt, Duane Eldon, 1948 (23)
Chesney, Robert Hamlin, II, 1948 (23)
Englert, Richard Kenneth, 1948 (26)
Erickson, Harold Willard, 1948 (27)
Harris, Frank Nelson, 1948 (22)
Hemmeter, Bernard Henry Robert, 1948] (26)
Larson, Edward William, Jr., 1948 (25)
O'Neill, John Michael, 1948 (24)
Theodore, Theodore John, 1948 (24)

UNIV. OF NOTRE DAME

O'Malley, John Barron, Jr., 1948 (25)
Prescott, Charles Bradford, Jr., 1948 (24)
Stubler, Peter Allen, 1948 (24)
Wilcox, Marion Walter, 1948 (26)
Witt, John Denton, 1948 (24)

OHIO STATE UNIV.

Mohler, Roy James, 1948 (26)
Parker, Richard Neal, 1948 (22)
Smith, Charles Perroncel, 1948 (25)
Tipton, Roderick William, 1948 (23)

OKLA. A. & M. COLL.

Sullivan, Warren Ernest, 1948 (27)
Witt, John David, 1948 (27)

UNIV. OF TEX.

Anderson, Ben Howard, 1948 (24)
Bearden, Elvis Louis, 1948 (31)
Beckham, Joe Warren, 1948 (26)
Bryant, Frank Grant, Jr., 1948 (24)
Cleveland, Ray O., 1948 (28)
Cook, Herbert Merrel, 1948 (24)
Ferris, Theodore Croxford, 1948 (30)
Flynn, Harold Joseph, 1948 (22)
Hardeman, Edward Lent, 1948 (21)
McGee, Wayne Philip, 1948 (24)
Nolan, Lonnie Marshall, 1948 (22)
Stockton, John Dow, 1948 (31)
Whaley, Francis Lavern, 1948 (23)

TULANE UNIV.

Davis, George Bel, 1948 (25)
Walker, John Edward, 1948 (21)

UTAH STATE AGRI. COLL.

Francis, Ronald Lee, 1948 (22)
Stalwick, Roy William, 1948 (31)

VA. MIL. INST.

Malmo, Richard Carter, 1948 (26)

VA. POLY. INST.

Kuhn, Paul Peter, 1948 (22)
Schaub, James Hamilton, 1948 (23)

UNIV. OF VA.

Sadler, Joseph Bernard, 1948 (28)

WASH. STATE COLL.

Ray, Edworth Lillard, 1948 (21)

WASHINGTON UNIV.

Maack, Robert Sedgewick, 1948 (30)

WAYNE UNIV.

Jeziorski, Frank Edmund, 1948 (24)
McClurg, William Lutz, Jr., 1948 (26)

W.VA. UNIV.

Foreman, James Earl, Jr., 1948 (26)

UNIV. OF WIS.

Rezin, Arthur Irving, 1948 (26)

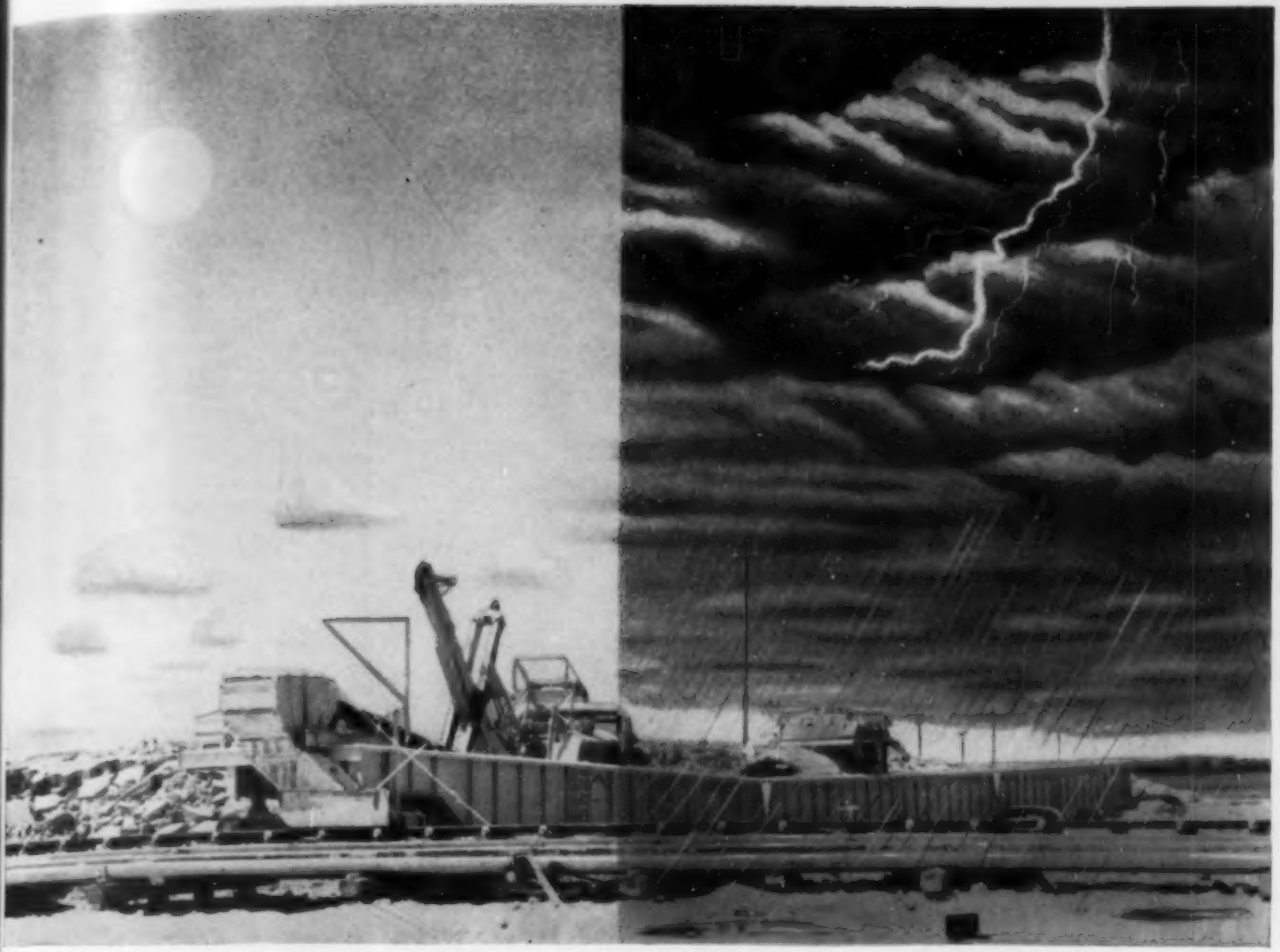
WORCESTER POLY. INST.

Kern, Otto, Jr., 1948 (20)
Lund, Birger Dietrichson, Jr., 1948 (28)

UNIV. OF WYO.

Holzinger, Robert Max, 1948 (28)
Lewis, Richard Eldon, 1948 (24)
Satterthwait, Donald Richard, 1948 (25)

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.



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EQUIPMENT, MATERIALS *and Methods*

NEW DEVELOPMENTS OF INTEREST, AS REPORTED BY MANUFACTURERS

Motor Grader

ALLIS-CHALMERS HAS ANNOUNCED the new BD as the latest addition to the Motor Grader Line. This 50-hp machine, specifically engineered for low cost maintenance and construction work, is particularly designed to economically meet the needs of governmental bodies and contractors. Headlining a list of exclusive Allis-Chalmers features on the new BD is the accepted tubular frame design which has proved so successful on the heavy-duty AD grader. Tests and experience have demonstrated that cylindrical sections have the natural qualities to distribute and absorb shocks and stresses through flexing action. Blade maneuverability on the new BD offers operators the extensive blade range required to suit a variety of jobs. A 28-in. clearance from the cutting edge of the blade to the circle enables the BD to accommodate the capacity loads that pass through the 22 in. axle clearance without disturbing the rolling action of the load. Precision adjustment of the blade from the operator platform facilitates bank cutting, handling of big windrows wasting dirt up

Motor Grader

banks and enables the operator to work exactly to specification with a minimum of effort. Accessible controls and convenient gear shifting arrangement that give six speeds forward ranging from 1.30 mph to 14.69 mph and three reverse speeds ranging from 1.55 mph to 5.41 mph contribute to greater operator efficiency and increased production. **Allis-Chalmers Mfg. Co., Tractor Div., Milwaukee, Wis.**

Fast Concrete Cutter

A NEW STRATEDGE Concrete Cutter, highly practical for either large or small jobs, not only cuts fast, up to 60 in. per min, but clean, leaving sharp, straight edges, and sharp 90-deg angles at corners. The Cutter is driven by a 6-hp engine, and is equipped with a specially designed diamond saw. Because it is easily transported and requires only one man to operate it, the Cutter can be used economically on small scattered jobs. It is said to cut and score equally well on a variety of materials, including concrete, marble, tile, asphalt, and terrazzo. **Backlin Products Co., Burlington, Wis.**

Transit-Level

TEN NEW IMPROVEMENTS have been incorporated recently in the improved Model 3000 Universal Transit-Level made by the David White Co. of Milwaukee, Wis.

Transit-Level

This instrument is designed especially for building and construction work and all survey and check-up operations on building and road construction. The modifications include an increase in the vertical arc from 3 to 4 in. with vernier reading to five minutes. The telescope axle now has a permanent bearing hold-down adjustment. A special adjustment has been added to the lock levers for locking the instrument in the level position. A large shifting base, or center, permits shifting of the instrument seven-eighths of an inch over a given point without moving the tripod and the clamp and slow motion (tangent) screws provide both horizontal and vertical motion for fine adjustment. This improved instrument comes complete with a hardwood carrying case, sunshade, dust cap, adjusting pins, plumb bobs, full length split leg tripod, and instruction book. **David White Co., Milwaukee, Wis.**

Arc Welder

THE NEW WILSON "Wasp Special" is an air-cooled, engine-driven, arc-welding machine announced recently. The "Wasp Special" is designed to furnish a smooth steady current and to stand up under usual and regular duty factor load conditions in tough construction and maintenance jobs. This new 200-ampere arc welder has a welding range of 25 to 250 amperes at 30 volts, 50% duty cycle. It is a light weight machine that is easy to handle and ideal for work in places inaccessible to larger and heavier equipment. Two convenient outlets are provided which may be used for lighting purposes or to operate universal power tools in an emergency. **Air Reduction Sales Co., Dept. A 1777 P, 60 E. 42nd Street, New York 17, N.Y.**

Jumbo Drill

THE NEW INGERSOLL-RAND air-powered drill jumbo features air-powered booms which can be raised or lowered at the touch of a lever. It was designed for high-speed driving of drifts, crosscuts and tunnels, and is capable of working in an opening with a height up to 9 ft and with a width varying between 5 and 14 feet. All controls are located on the front end of the booms where they are convenient to the operator. The air motors which raise or lower the booms insure a positive screw drive. The booms are locked into position and cannot creep or settle during the drilling operation. The jumbo car is built of heavy-gage steel and is completely welded throughout. It is equipped with tool boxes at both the front and back, and generous space has been provided for the storage of detachable bits. Drill steel is carried in the hollow portion of the frame above the wheels. **Ingersoll-Rand Co. 11 Broadway, New York 4, N. Y.**

Jumbo Drill

New Compaction Machine

TEST RESULTS SHOW that the Cedarapids Compactor, a machine entirely new in design and principle for compacting soil and aggregate will produce a very noticeable increase in density of soils at depths of 3 ft and more. Another important result is that it is possible to spread lifts of much greater depth and compact them to the required density. The Compactor operates on the principle of flotation of heavy loads without lateral soil displacement, aided by a vibratory action of forces producing a directional depth penetration of pressure. This combination produces maximum compaction and density satisfactory for construction specifications without affecting the top surface. The Compactor can easily be adjusted to meet the requirements of different soil conditions by changing tire pressure or weight of the unit. The vibratory action which produces a tamping action through the tires is created by a vibrator unit mounted on the axle and held down by super-imposed springs. Power for operating the vibrator is supplied by a 35-hp engine. By means of an adjustable governor, the vibrations can be controlled through a range of 700 to 1,400 cycles per minute depending on soil re-

quirements. The Compactor will assure excellent compaction as a rubber-tired roller without the engine running but with the vibratory action an additional 3 to 10% additional compaction is produced. The Compactor may be towed by either rubber-tired or track-type tractors at speeds of from one to two and a half mph. **Iowa Mfg. Co., Cedar Rapids, Iowa.**

Berm Leveler

A BERM LEVELER for maintenance along hard-surfaced roads has been developed by the Huber Manufacturing Co. in cooperation with highway engineers to fill the need for a one-man operated unit. The leveler is attachable to the standard Huber Maintainer. A reversible assembly for boulevard and divided highway maintenance and unobstructed view of the work being done are other features of this Maintainer auxiliary unit. Hydraulic controls operate the blade of the Maintainer to the angle and depth necessary to carry sufficient material to the pavement edge. An apron, or gathering blade, is bolted to the Maintainer moldboard. This carries excess material picked up in cutting the berm and deposits it in ruts or low spots along the edge of the surfaced road. The rear wheel of the Maintainer, which runs along the edge of the pavement, compresses this material. The berm leveler, mounted on the rear of the Maintainer, is adjusted by hydraulic control to the desired pressure for moving excess material and feathering it out to form a level berm. Small stones and dirt left by the berm blade are removed from the edge of the pavement by a road cleaner blade mounted on the rear of the leveler attachment. Here is an on-the-job picture of Huber's new berm leveler, latest addition to the company's auxiliary units for the Maintainer. **Huber Manufacturing Co., Marion, Ohio.**

Berm Leveler

Self-Priming Centrifugal Pumps

AN INTERESTING DEVELOPMENT in the design of self-priming centrifugal pumps for drainage work is Jaeger Machine Company's use of overall housings which protect the engine as well as the pump from weather and dirt. Keeping water from spark plugs, carburetor, and crankcase insures quick starting and more efficient operation and added life to the engine. Side panels give instant access to all operating controls, and enclosures lift off when necessary. The factory individually tests and certifies each pump for vacuum, capacity, and pressure. **The Jaeger Machine Co., Columbus, Ohio.**

New FWD Maintainer

The 1948 FWD Maintainer, is designed especially for maintenance of dirt and gravel roads. The new model embodies all of the basic principles of FWD design, it being a standard model in the company's "H" series, and is designated the HG. It has a gross rating of 20,000 lb and a chassis weight of 8,000 lb. Standard wheelbase is 154 in. and the frame length back of the cab is $121\frac{1}{2}$ in.

The design feature which especially fits the FWD Maintainer into road maintenance work is the frame height—high enough to accommodate any underbody maintenance blade. With 9:00 × 20 tires standard with the truck, the frame height of $45\frac{1}{2}$ in. is provided with the truck empty and $40\frac{3}{4}$ in. with the truck loaded to capacity. The extra frame height is made possible by high arched springs and overhead spring shackle mounting.

FWD Maintainer

Balanced load distribution is another important factor. Design of the FWD Maintainer concentrates the load on the rear axle, and as a result, the blade action is more regular. The FWD Maintainer is a highly mobile unit, capable of traveling miles to its job, maintaining the road, eliminating holes and washboard, and then traveling any distance to a second job or third job, and finally back to its base of operation. Little time is lost in travel from job to job, a distinct saving. **Four Wheel Drive Auto Co., Clintonville, Wis.**

Half-Sack Mixer

A new, gasoline-engine driven cement mixer, model 35-25VR, is a half-sack mixer, rated at $3\frac{1}{2}$ cu ft and 10% capacity. The manufacturer plans to market this machine through dealers, contractors and builders as the lowest priced quality mixer of its class. The 35-25VR includes a heavy semi-steel cast bowl and yoke; scientifically designed blades for fast, thorough mixing action; a newly designed tilt gear for mixing and pouring from either side. A heavily reinforced angle frame supports engine and mixing chamber and is provided with a retractable tow-tongue. Engine power is provided by a 3-hp air-cooled gasoline engine driving through multiple V-belts. The mixer is mounted on high-speed trailer with two 6:00 × 16 pneumatic tires. **Vanco Products, Inc., 130 S. Weber St., Colorado Springs, Colo.**

The Second of a Series in the interest of more efficient use of steel . . . a vital American resource.

Power-Cart

New Lettering Instrument

The Varigraph Lettering Instrument is a small mechanical device for reproducing many sizes of letters from a single templet directly in ink or pencil on any suitable surface. The letters may be reproduced to any desired width combined with any desired height between 0.075 and 0.750 of an inch. Letter width and letter height are controlled by positioning two knobs.

Resting directly on the surface being lettered the Varigraph slides against any straight edge in being moved from one letter to the position of the next letter. A Varigraph Lettering Templet carried by the instrument slides left and right to position in the instrument the desired letter. To reproduce a letter a finger-operated point follows the letter grooves in the lettering templet.

This instrument is unique in that it can be used with equal ease by either the right- or left-handed person. For left-handed operation the instrument is placed so that the lettering arm is to the right of the operator. Lettering may be done direct on paper, tracing cloth or other material. The manufacturer claims a saving of as much as 90% of the time now required for hand lettering.

The Varigraph will reproduce a copied figure without distortion at variable height-width ratios. Engineers will be interested in this ingenious mechanism which varies the ratio of the horizontal and vertical components of the line direction to be copied. The mechanism comprises a number of cooperating links which transmit movement from input to output. All parts are corrosion resistant and are enclosed by a varigated case molded of Tenite which is secured to an alumilited base. **Varigraph Co., Inc., Lincoln 3, Nebr.**

Foilclad Pipe Units

An exclusive feature of Foilclad pipe units for overhead distribution of oil, viscous fluids, process liquids, and steam lies in the fact that pipe in these units is insulated at the factory to meet individual project specifications. Foilclad units are shipped in 21-ft sections, completely prefabricated and ready for installation with only one handling required at job site. Time and cost of installation are thus minimized. In the prefabrication of these units at the factory, asbestos, cork, or other insulation, as specified, is machine coated with high-temperature asphalt and tension wrapped with asphalt-saturated asbestos felt. A second coating of asphalt is followed by a tension wrapping of aluminum or copper foil which forms a perfect bond with the asphalt. The result is a highly efficient, durable unit completely waterproof and weather protected. A variant of the basic type of Foilclad unit employs a pipe supported within a pipe with insulation around the outer pipe. In this way, any desired temperature can be maintained within the pipes. Either pipe can carry the process fluid while the other carries the heating or cooling medium. **Dept. 8682B, The Ric-Wil Co., Cleveland, Ohio.**

Power-Cart

Designed to reduce back-breaking labor and construction job costs, a motorized wheelbarrow has been devised which will carry 1,500 lb or 9 cu ft of concrete. Although capable of carrying all construction materials and small equipment, the "Power-cart" is especially advantageous for the transportation of concrete. Dumping can be effected from either sitting or standing position and is easily done because the load is balanced in the tray. The entire unit weighs 600 lb, is $81^1/_2$ in. long, and the loading height is 31 in. A unique feature is the tiller, which not only controls the front and reverse gear, but also acts as a steering mechanism, one lever only for steering and direct control. The power unit is $2^1/_2$ hp (minimum) air-cooled gasoline engine with V-belt and chain drive. It is detachable from the cart by four bolts permitting its use on flat-bed or other type carts and making it a universal power unit for all types of work. Transmission, one forward, one reverse. Speeds are foot-throttle controlled. The turning radius is 4 ft and the speed is 6 to 8 mph. **Gar-Bro Mfg. Co., 2416 E. 16th St., Los Angeles 21, Calif.**

Model C Tournapull

The new Model C Tournapull has recently been added to the LeTourneau line of high-speed earthmoving equipment. This rubber-tired unit is designed and built to answer the need for a medium sized, high-speed earthmoving tool in all construction fields. The new Tournapull is used with the Model E16 Carryall Scraper which has a capacity of 13.3 cu yd or 16 tons. This unit, which is powered by a 150-hp 6-cylinder diesel engine, has four forward speeds ranging from 2.19 to 17.3 mph. One of the developments included on the new C Tournapull is electric control of Tournapull steering, scraper bowl, apron and tailgate by individual electric motors. Steering and scraper operations are controlled through these motors by means of toggle switches on the control panel of the Tournapull. According to the manufacturer, another "ease of operation" feature of the C Tournapull is a constant mesh transmission which gives instantaneous selection of gear ratios without shifting gears or loss of momentum. A torque proportioning differential is another LeTourneau development included in this machine. The C Tournapull has more than a 90 deg turning angle and can turn around in 14 ft 6 in. less than its over-all length. This makes the rig maneuverable on narrow cuts, fills, haul roads or turns. Over-all specifications of the C Tournapull with the E16 Carryall Scraper are: length 31 ft; height 9 ft 3 in.; with 11 ft 4 in.; wheelbase 18 ft 2 in.; and empty weight 29,220 lb. High production, speed, maneuverability and job-to-job mobility make this medium sized Tournapull adaptable for road work, levees, airports, railroads and dam construction and in leveling, mining, industrial and stripping operations. **R. G. LeTourneau, Inc., Peoria, Ill.**

Literature Available (Cont.)

PARTNERS WANTED

A number of large dams of different kinds are going to be constructed in various parts of India in the near future. These dams for speedy completion require trained engineers and mechanical equipment which at the moment are lacking in this country and shall have to be imported from abroad. Representatives of various construction companies in U. S. A., U. K., France, Switzerland and other countries in the world are anxious to undertake these works, but their chief handicap lies in total absence of knowledge of local conditions and contacts. Our firm which has large financial backing and considerable influence in the country and has several industrial undertakings is prepared to enter into partnership with such firm as may like to undertake construction of large dams in India. Correspondence may be made in confidence with **Seth M. R. Jaipuria, Swadeshi House, Civil Lines, Kanpur (U. P.) India.**

Literature Available

Proportioning Pyrometer Controller—Bulletin PB1237 describes the development of a proportional current-input electronic pyrometer controller. The new instrument proportions the current input to electrically heated furnaces, ovens, plastic molding machines, salt pots and other similar equipment to provide practically straight-line temperature control. It does this by time modulation of the input energy. The average energy supplied is proportional to the deviation of the temperature from the control point throughout a band width, which is adjustable from 0 to $2^1/_2$ percent of full scale reading. **The Bristol Co., Waterbury 91, Conn.**

Pavement Breaker—A new gasoline pavement breaker and rock drill, Model H-6B, is described in a well illustrated booklet. This new Barco hammer is said to be the fastest and most powerful gasoline hammer perfected up to this time. A 6-volt storage battery of the ordinary automobile type is recommended for carrying ignition to the hammer, where recharging facilities are available. Otherwise, a 9-volt dry cell battery may be substituted. Operating expense amounts to only a few cents an hour. This includes fuel consumption of one quart per hour of mixture of gasoline and oil, replacement of piston spring when it becomes too short for effective use, and recharging of storage battery or replacement of dry battery **Barco Manufacturing Co., Chicago, Ill.**

Floor Armor Booklet—A 20-page technical manual describing the uses of and how to install floor armors and surface armors. The instruction manual explains how to lay either Hexteel or Floorsteel in new concrete, over wooden floors, or old concrete and mastic. It also explains the recommended fills such as concrete, asphalt, hot or cold mastic, magnesite and special fills. An extra chapter instructs how to repair broken or crumbling floors with the steel armours. Copies of the new catalog or of the Floorsteel, Hexteel, Safety-Mat or Grating catalogs can be obtained by writing to **Emerson C. Whitney, Wm. F. Klemp Co., 6610 S. Melvina Ave., Chicago 38, Ill.**

High Mobility Bucket Loader—The nimble K-5 Bucket Loader, built heavily enough for pit and road work yet quickly maneuverable in busy yards, is described in a bulletin just released. The bulletin tells in detail about the unit which is equipped with a two-strand elevator and four-speed transmission. Separate Twin Disc clutches control traction and elevator, the latter having an automatic overload release. Feeder spirals "pick before they shovel," loosening the material and heaping it into buckets at speeds up to 2 yards a minute. The K-5 handles earth, gravel, or broken stone up to $2^1/_2$-in. size. It moves under its own power over short distances and is equipped with self-steering tow bar for towing between more widely scattered jobs. Power unit is 27-hp Le Roi gasoline engine. **Dept. 6A, N. P. Nelson Iron Works, Inc., Clifton, N.J.**

Literature Available (Cont.)

Air Intake Cleaner-Snubbers—Bulletin No. 485, covering the new ICS-series Combination Air Intake Cleaner-Snubbers, is announced by Burgess-Manning Co., Libertyville, Ill. The illustrated bulletin discusses mounting, cleaning, time saving and the long life of the ICS-series Cleaner-Snubbers. Listed as outstanding features are: easy removal of filter element, combined air cleaning with effective snubbing, heavy-duty construction, and negligible resistance to air flow. **Burgess-Manning Co., Libertyville, Ill.**

Corrosion Protection—A new 4-page folder showing how to cut costs in areas where corrosion is a problem was recently released by Prufcoat Laboratories, Inc. Included in this informative bulletin are many actual case histories from leading plants in many different types of industries which are now using Prufcoat coatings. In pictures and statements these users tell how Prufcoat coatings cut painting maintenance costs by providing machinery, equipment, walls, floors, etc., with effective protection against corrosion from acids, alkalies, oil, and water. A copy may be obtained by writing direct to **Prufcoat Laboratories, Inc., 63 Main St., Cambridge, Mass.**

Hoisting Machinery—A 19-page booklet in two colors, designated as bulletin H-414, illustrates and describes the entire line of products manufactured by the Superior-Lidgerwood-Mundy Corporation, of Superior, Wis. The booklet contains illustrations and text matter on steam hoists; gear- and chain-driven hoists; gasoline, diesel or electric; capstans and carpullers; boom swinging gears; hoists for special application; and floating derricks. Accompanying the diagrams are charts, graphs and data on these products. An entire page is dedicated to special specifications as to duty ratings, drums, breaks, gearing, shafts and others. **Superior-Lidgerwood-Mundy Corporation, Superior, Wis.**

Airport Design Manual—The new 32-page "Design Manual of Airport Pavements (AP-10)," edited and compiled by the Technical Service Division of the Wire Reinforcement Institute, Inc., contains the latest essential and reliable information on the use of welded wire fabric reinforcement in airport pavement construction. In this manual the designer and engineer will find the sound practical material so essential to the economical design of landing facilities. Information on the use of welded wire fabric reinforcement in concrete runways, taxiways, turnarounds, aprons and drainage systems is gathered here to support the judgment and knowledge of the airport designer and engineer. Authoritative technical and field data are gathered together and presented in concise logical form, and conform to the latest C.A.A. requirements for projects planned under the Federal-Aid Airport Act. Charts, graphs, tables and formulas are included. Address requests to **Mr. T. J. Kauer, Managing Director, The Wire Reinforcement Institute, 1049 National Press Building, Washington 4, D.C.**

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